MONT-MÉGANTIC AREA INTERNATIONAL DARK SKY RESERVE

NOMINATION PACKAGE
(SILVER TIER)

Submit to International Dark-Sky Association

By Chloé Legris, Eng. Project manager
August 2007

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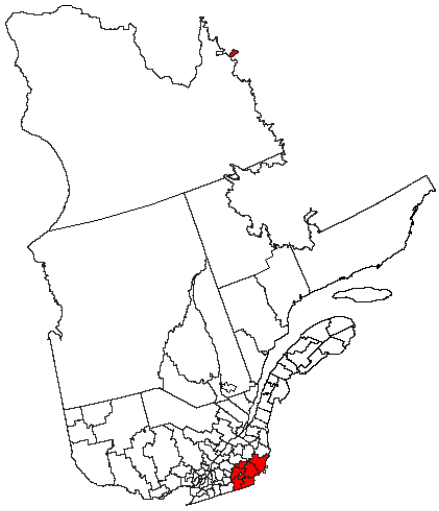
1 EXECUTIVE SUMMARY

The Mont-Mégantic Area is located in the Eastern Township (red part) of the province of Québec in Canada, (map above)



There's are three 3 Municipal Regional County Municipality (MRC) directly concerned by this project: MRC of Granit, MRC of Haut-Saint-François and MRC of the city of Sherbrooke city. These 3 three MRC's are part ofall in the Eastern Township County, which covers 7 MRC's. The core of the Reserve is the Mont-Mégantic National Park and the Reserve extend up to the city of Sherbrooke's city.

The light pollution abatement project in Mont-Mégantic Area has begun in 2003. Since then many awareness, regulation and conversion actions have been leaded by the Mont-Mégantic ASTROLab. The operational cost of this project during its first 3 years was of 200 000 CND$. Financial support came from different local organisation and mainly from Natural Resources of Canada.

Awareness and lobbying have represented an important part of the project, bringing an increased interest towards the sustainability of the most important research center in astronomy in Canada and the potential energy saving through outdoor lighting control.

The awareness was essential and very helpful to get through the regulation and lighting fixture replacement project. We can now count 32 municipalities that have adopted a full regulation on outdoor lighting control (light sources, uplight from lighting fixtures, lighting levels and operating hours) within a 50 km radius around the Mont-Mégantic in addition to the city of Sherbrooke city (60km away). In august 2006, an important lighting fixtures conversion plan of 1.4 million CND$ was started to reduce light pollution by 25% and to save at least 1.3 gWh/year. About 2500 lighting fixtures are now being replaced within 16 municipalities around the Mont-Mégantic.

By February 2008, all of the Action Plan objectives will be met. Future will then be assured by local leaders greatly involved, and through an effective regulation.

As you'll see in more details in this nomination package, we have build up very strong bases to protect Mont-Mégantic Dark Sky and we hope this will clearly encourage IDA Board of Director to certify Mont-Mégantic Area as a First International Dark Sky Reserve. We believe that this recognition will have great impact at local, national and international levels. It will also greatly

contribute to consolidate the population and leaders engagement to the reduction of light pollution

2 CONTEXT: THE ASTROLAB, THE NATIONAL PARK AND THE OBSERVATORY OF MONT-MÉGANTIC

Mont Mégantic is located within the Mont-Mégantic National Park (Québec, Canada) which also includes an Educational Center in Astronomy (ASTROLab) and a Professional Observatory that belongs to Montréal, Laval and McGill Universities.

From the Earth to the Stars! No slogan could be better suited to Mont-Mégantic National Park.

Mont-Mégantic National Park (5845 hectares) is an exceptional and natural environment to discover. It's possible to enjoy its 75 km of trails in altitude and experience the transition between a colourful mixed forest and a coniferous forest while you hike to reach a summit above 1 000 m. in altitude.

This site is also well known for it's amazing amount of snow fall each winter. This makes it the one of the best places to enjoy beautiful sceneries from the 33 km snowshoe trails or the 27 km cross-country skiing trails.

At the Mont-Mégantic National Park, there's also many activities related to Nature and History, but its distinctive signature, is the astronomy program offered by the ASTROLab!

The Mont-Mégantic ASTROLab is an astronomy activity center dedicated to the general public offering many activities including interactive exhibitions, a high definition multimedia show at the base of the mountain, tours of the observatories (public and professional) at the summit, astronomy evenings and much more! Mont-Mégantic ASTROLab is also a non-profit organisation who's Board of Directors includes the National Park's Director, the Observatory's Director, representatives from the Local Development Center and some others.

The Mont-Megantic Observatory (OMM) is one of the best-instrumented University Research Centres in the World. It houses a 1.6-meter telescope, which is the third largest in Canada. The Observatory has the darkest sky of all the research Observatories in Canada, which makes it one of the best facilities in the country.

Because of the treat created by light pollution on the research capabilities and scientific effectiveness of the Mont-Mégantic Observatory, the "Light Pollution Abatement Project" was initiated four years ago by the Mont-Mégantic ASTROLab coorporation.

This picture, taken by Guillaume Poulin, show the beauty the Mont-Mégantic summit (Aurora Borealis on the right, stars up in the sky) and the threat caused by light pollution (on the left). This picture won the IDA digital contest in 2006.

3 NOMINATION AND SUPPORT LETTERS

ASTROLab du Mont-Mégantic

OMM

Parc national du Mont-Mégantic

Notre-Dame-des-Bois, the 1st of July 2007

Board of Directors
International Dark Sky Association
3225 North First Avenue
Tucson, Arizona 85719-2103
USA

NOMINATION OF MONT MÉGANTIC AREA INTERNATIONAL DARK SKY RESERVE

Dear IDA Board of Directors,

We, manager of all three instances co-habiting in the Mont-Mégantic National Park, wish to nominate the Mont-Mégantic Area to become the First International Dark Sky Reserve.

Over the past decades, we have seen the mont Mégantic area sky's quality decrease because of light pollution caused by the surrounding communities. This has brought us to build up a specific project five years ago to protect and restore our night sky in order to preserve the effectiveness of the Observatory and the specific mission of the site regarding astronomical public education. As you'll see in this nomination package, many successful actions have been leaded and we're very proud of the results.

This project has made a clear difference, especially concerning awareness and light pollution reduction. The lighting conversion plan is amazing! Even with only half of the replacement done and even if no quantitative measurements of light pollution are done yet, we can visually testify on the great improvement of the night sky.

In the last five years, the work accomplish by our full time project manager gave us the opportunity to establish strong base for starry nights preservation, but, our respective roles as managers of an astronomical observatory and research center, an educational center and a National Park, will clearly contribute to ensure the long term of theses actions. Our role brings us, in many opportunities, to work with population, politicians, local leaders and many others.

We hope this document will convince you of the exceptional commitment of all and will give you the assurance of our respect towards this great recognition.

Sincerely,

Gilles Joncas, Director
Research center of Mont-Mégantic Observatory

René Doyon, Director
Observatory of Mont-Mégantic

Pierre Goulet, Director
Mont-Mégantic National Park

Bernard Malenfant, President
Mont-Mégantic ASTROLab

FÉDÉRATION DES ASTRONOMES AMATEURS DU QUÉBEC
4545, AV. Pierre De Coubertin, C.P. 1000, Succursale M, Montréal (Québec) H1V 3R2
Téléphone: (514) 252-3038 - Télécopieur : (514) 251-8038

Montréal, the 1st of July 2007

Board of Directors
International Dark Sky Association
3225 North First Avenue
Tucson, Arizona 85719-2103
USA

Dear IDA Board of Directors,
The Québec Section of IDA is proud to encourage and support the nomination of Mont-Mégantic area to become an internationally recognised Dark Sky Reserve. Since 2003 the Mont-Mégantic ASTROLab is leading an exceptional project to reduce and limit growth of light pollution around the Mont-Mégantic Observatory.
In addition to the benefits of preserving the dark sky and astronomical research, the project also contributes to the development of new ways to manage outdoor lighting for other areas of the Québec Province.
All the steps made to realize this ambitious project have been followed closely by the Québec Section of IDA. The great diversity of expertise within our committee and the knowledge we have of this project, able us to attest that the content of this nomination package; regulation, conversion plan, communities and population involvement are all very successful.
We therefore solicit the IDA Board of Director to give this nomination package a very close attention and recognise the Mont-Mégantic area as a Dark Sky Reserve.

Thank you in advance for your support

Rémi Lacasse
Director of IDA-Québec section, former President of FAAQ

Québec section members:

André Bordeleau: Scientific educator Planetarium of Montréal

Chrisnell Blot, Eng: President of Spectralux Inc., Lighting laboratories

Germain Gauthier: tech.IESNA.GVA, Regional sales manager Lumec

Gilles Meunier, Eng: Hydro-Quebec

Richard Poirier: Senior Architect DCYSM

Raymond Pronovost: Member of Board of Director of FAAQ

Mihai-Razvan Pecingina, Eng: Kelvin Emtech EXPERTS-CONSEILS

Pierre Tournay: President of Microvolt Electronics

Sylvie Tremblay, Architect: Lighting Plan coordinator, City of Montréal

Municipalité Régionale de Comté du Granit

Notre-Dame-des-Bois, July 13th, 2007

Board of Directors
International Dark Sky Association
3225 North First Avenue
Tucson, Arizona 85719-2103
USA

Dear IDA Board of Directors,

The Mont-Mégantic ASTROLab is leading since 2003 the light pollution abatement project in collaboration of Municipal Regional County (MRC) of Granit (19 municipalities) and Haut-Saint-François (14 municipalities) and Sherbrooke City. Since then, municipalities have been involved into awareness, regulation and lighting conversion actions.

These actions had a positive impact on our way to control outdoor lighting and on the importance of the night sky as one of our valuable resources to protect. Although there is still much work to do to consolidate our involvement and ensure the sustainability of these firsts steps, we truly believe that we are going in the right direction to do so.

We, political leaders, engage ourselves to protect the Mont-Mégantic area night sky by keeping the regulation active and well apply for years to come, be keeping our engineers, urban planners, municipal inspectors and electrician well informed about technical needs to manage efficiently outdoor lighting and by promoting the benefits of reducing light pollution towards our population through regular communication and awareness actions.

We consider the nomination of Mont-Mégantic Area as a First International Dark Sky Reserve an important to our region and wish to assure the IDA's Board of Director of our commitment towards this recognition.

Sincerely,

Maurice Bernier, Prefect MRC of Granit

5090 rue Frontenac • Lac-Mégantic (Québec) • G6B 1H3 • Téléphone : 819 583.0181 • Télécopieur : 819 583.5327
Courriel: secretariat@mrcgranit.qc.ca

M.R.C. du Haut-St-François

85, rue du Parc
Cookshire (Québec) J0B 1M0
Tél. : (819) 875-5451
Téléc. : (819) 875-3135
mrc@videotron.ca

LE HAUT-SAINT-FRANÇOIS
Le champ d'action et de consommation

Notre-Dame-des-Bois, the 1st of July 2007

Board of Directors
International Dark Sky Association
3225 North First Avenue
Tucson, Arizona 85719-2103
USA

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Sincerely,

Michel Gendron, préfet MRC du Haut-Saint-François

CABINET DE LA MAIRIE

SHERBROOKE (Québec)

Board of Directors
International Dark Sky Association
3225 North First Avenue
Tucson, Arizona 85719-2103
USA

June 29, 2007

Dear IDA Board of Directors,

The Mont-Mégantic ASTROLab is leading since 2003 the light pollution abatement project in collaboration of Municipal Regional County (MRC) of Granit (19 municipalities) and Haut-Saint-François (14 municipalities) and Sherbrooke City (150,000 of population). Since then, municipalities have been involved into awareness, regulation and lighting conversion actions.

These actions had a positive impact on our way to control outdoor lighting and on the importance of the night sky as one of our valuable resources to protect. Although there is still much work to do to consolidate our involvement and ensure the sustainability of these firsts steps, we truly believe that we are going in the right direction to do so.

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We consider the nomination of Mont-Mégantic Area as a First International Dark Sky Reserve an important to our region and wish to assure the IDA's Board of Director of our commitment towards this recognition.

Yours Sincerely,

Jean Perrault
The Mayor

CASE POSTALE 610, SHERBROOKE (QUÉBEC) CANADA J1H 5H9 • TÉLÉPHONE: (819) 821-5969

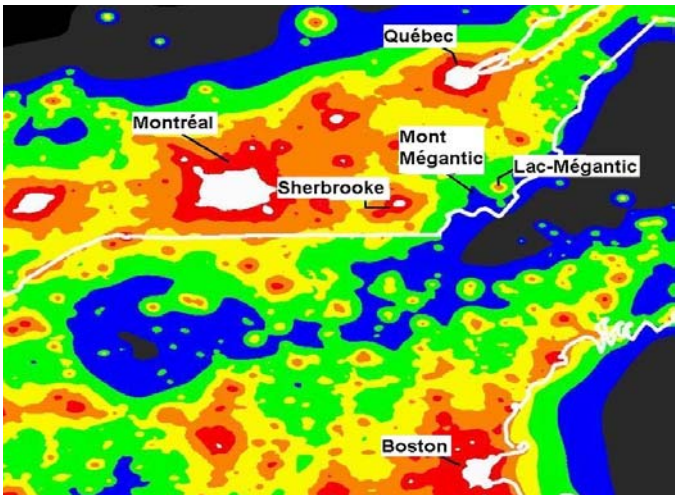
4 SKY QUALITY, LIGHT POLLUTION ORIGINS, MAPS AND MEASUREMENTS

At the beginning of the seventies, when Mont-Mégantic was chosen as the ideal site to build the observatory, night sky brightness was 25% greater than its natural level. Before the implementation of the control plan, light pollution was estimated to have doubled since the dedication of the observatory. In 2005, just before the lighting fixture conversion plan began, the visual limiting magnitude of Mont-Mégantic sky was estimated to about 6 – 6.5 magnitude and Bortle class 3.

4.1.1 Light Pollution origins

Through different methods, it was possible to estimate the origins of light pollution around the Mont-Mégantic Observatory. These informations were helpful to build an appropriate action plan.

Satellite image of light pollution in north-eastern of North America



Using Walker law (Walker 1997) to estimate the contribution of light pollution around Mont-Mégantic, combined with the federal population data statistics and satellite image, it was establish that light pollution origins were divided in three groups:

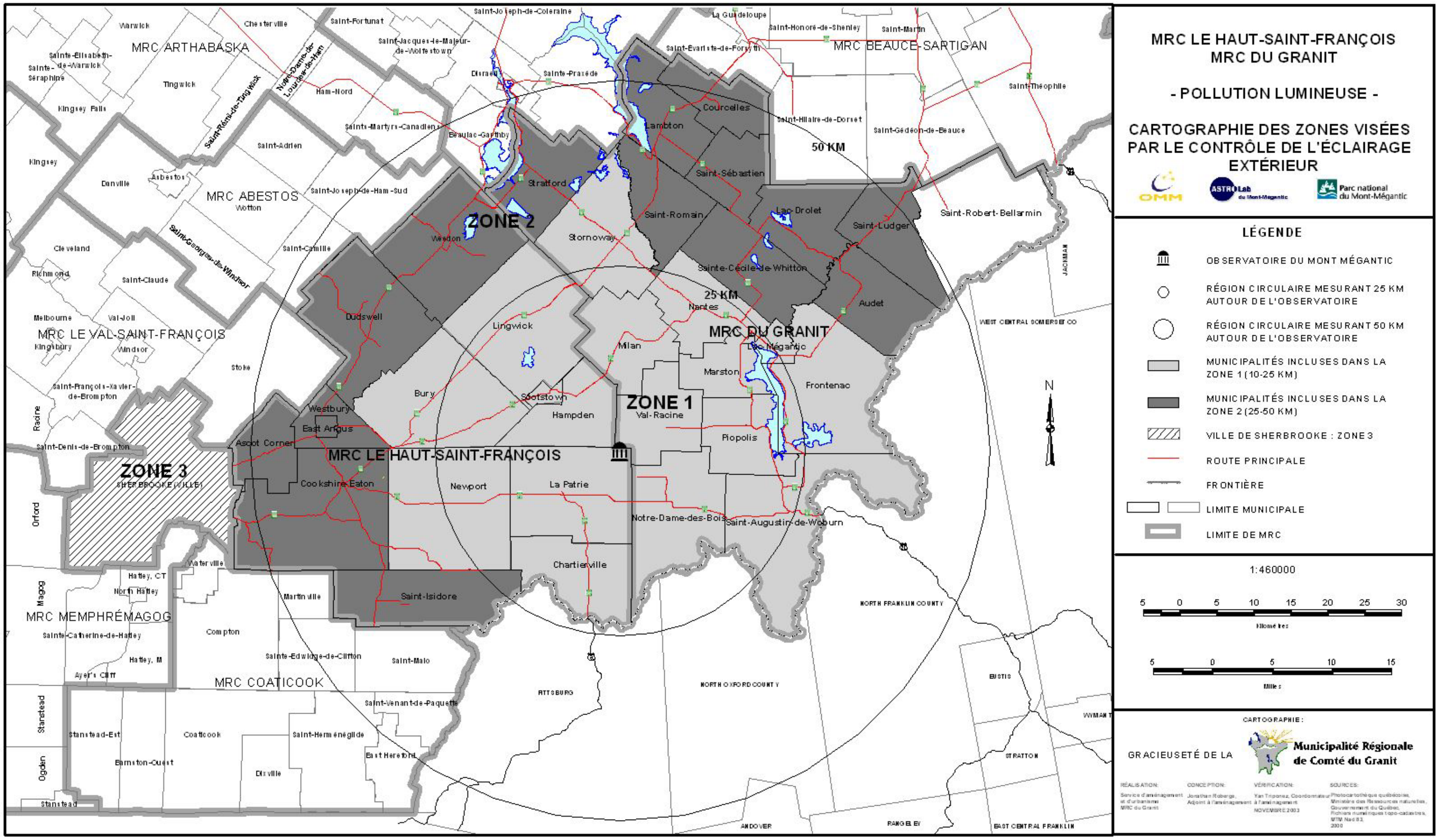
- **Close light sources**
  Even if the municipalities surrounding Mont-Mégantic are small, they contribute significantly to light pollution because of their proximity. All municipalities included in a radius of 25km around the observatory contribute to about 50% of the total light pollution. About 14 000 people live is this area.

- **The City of Sherbrooke**
  Although the city of Sherbroooke is 60 km away from the observatory, its size (175 000 pop.) makes it a great contributor to light pollution and is one of the greatest treat to the quality of the night sky of Mont-Mégantic. It generates about 25% of total light pollution.

- **Other light sources**
  All other small municipalities located in the 25 to 50 km radius are contributing to the other 25% of total light pollution.

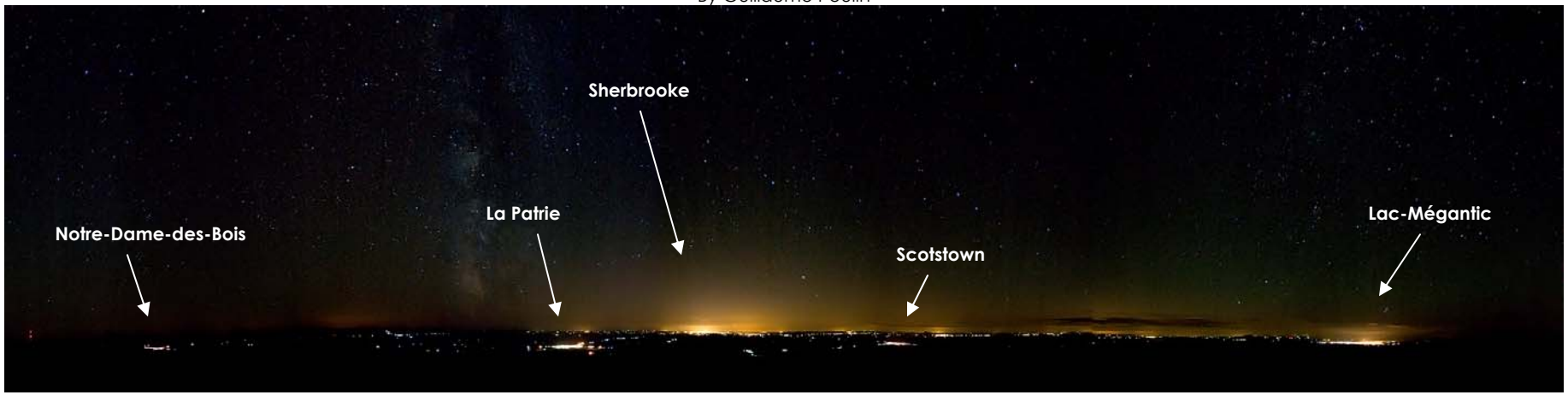
MAP OF THE THREE INTERVENTION ZONE

About 2500 lighting fixtures are actually being replaced in Zone 1 – End of replacement: February 2008



Panoramic view taken from the Mont-Mégantic Observatory (fall 2006)

By Guillaume Poulin



Here's a panoramic view taken just before the lighting fixture conversion. Another panoramic view will be available at the end of 2007. Lac-Mégantic, La Patrie, Notre-Dame-des-Bois, Scotstown and many other municipalities are part of the conversion plan.

On the left, here's picture taken from a shelter located at the top of Mont-Mégantic, about 400m away from the Observatory. It shows the great sky of the site, seeing the Milky Way!

4.1.2 Measurement program (SAND and OBSAND)

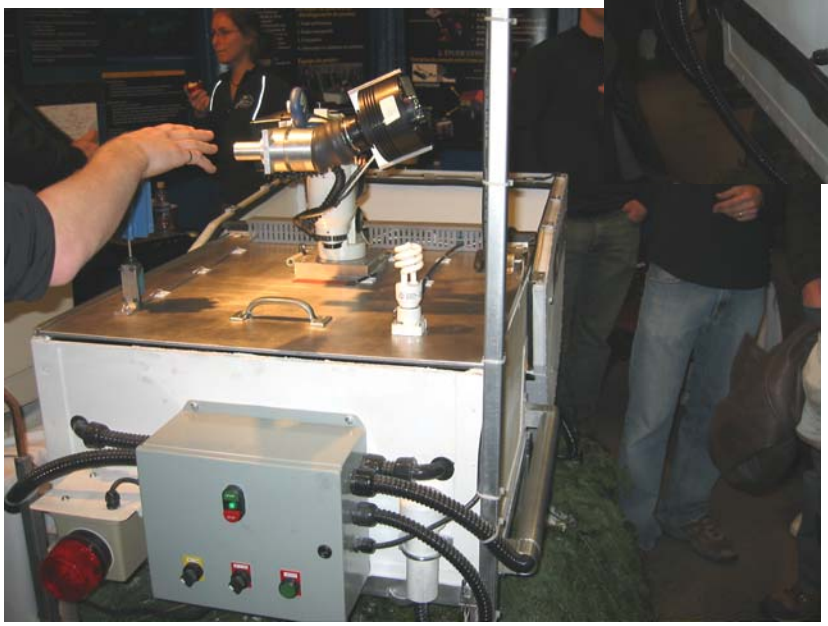
It was essential to measure the night sky trough precise data that could be followed over the years, and especially in order to determine the impact of the lighting fixture conversion plan. The measuring program is under the supervision of Dr. Aubé and all his results are available at www.graphycs.qc.ca. In the following pages are some of the firsts data compiled by SAND (Spectrophotometer for Atmospheric Nighttimes Detection) in fall 2006 at zenith and in direction of different municipalities at an angle of 30 degree above horizon. Each measure represents a field of approximately 15 degree. These preliminary results still have to be analysed more precisely and in fall 2007, some more measurements will be available to compare before/after the conversion plan.

This entire program is part of Dr. Aubé research, although, the long term measurement program will be transferred to the Mont-Mégantic Observatory in 2009, when OBSAND (permanent spectrophotometer/dome) will be finalised and installed at the top of Mont-Mégantic. Below, are pictures of OBSAND and in the following pages, the spectral measurements taken last fall.

In parallel, measurement were done in March 2007 with the 1,6 m telescope to provide a independent assessment of the sky spectrum. The data processing of this second data set in not yet fully complete.

OBSAND

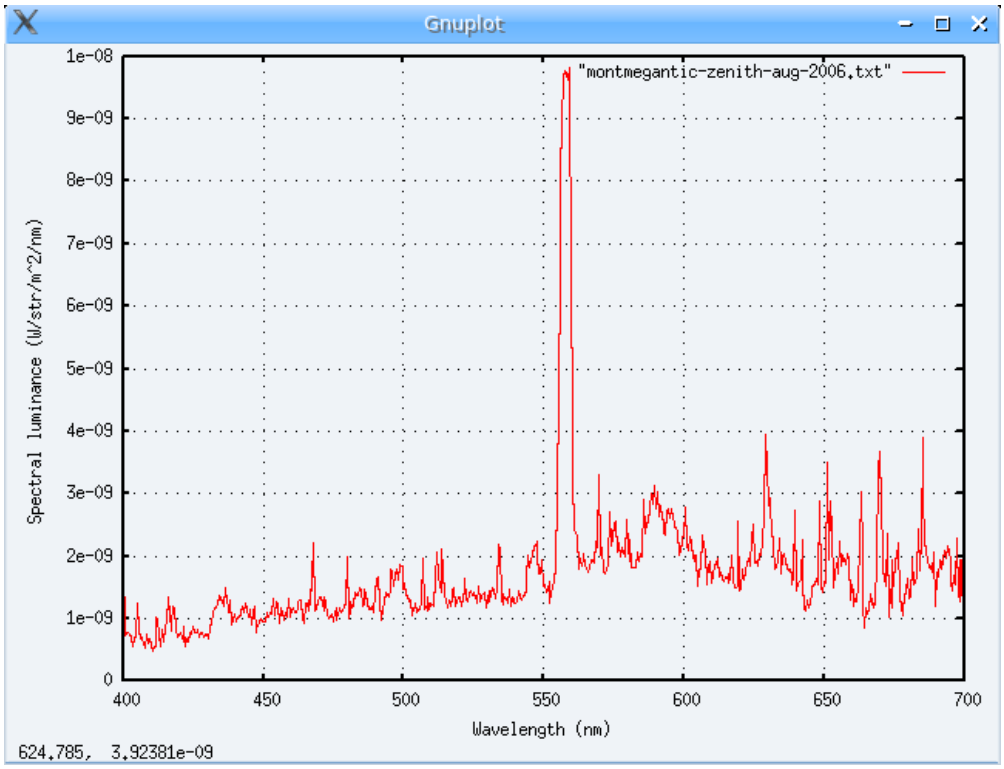
Observatory for the Spectrophotometer for Atmospheric Nighttimes Detection



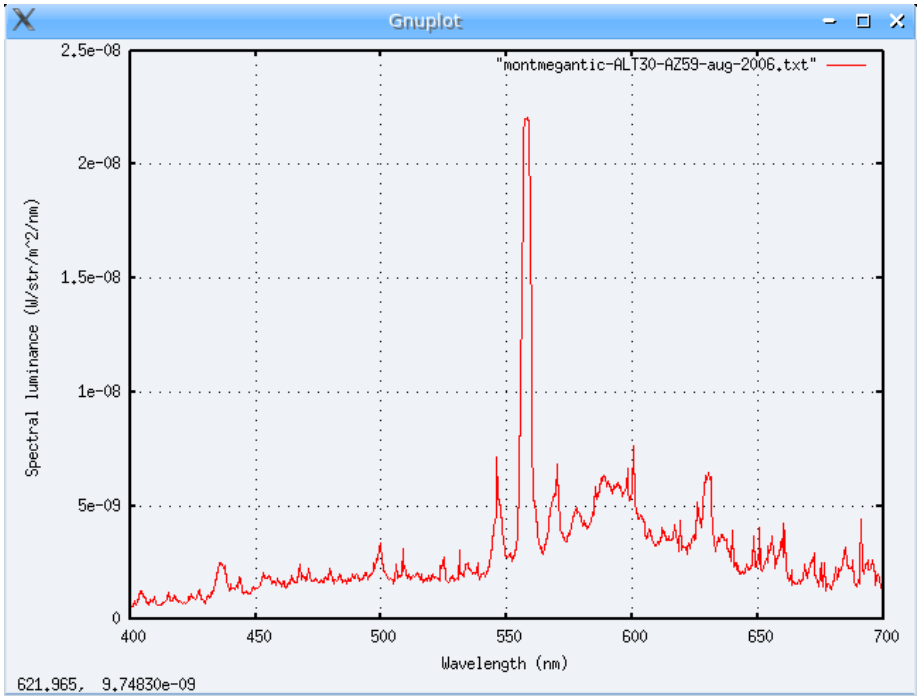
OBSAND

Observatory for the Spectrophotometer for Atmospheric Nighttimes Detection

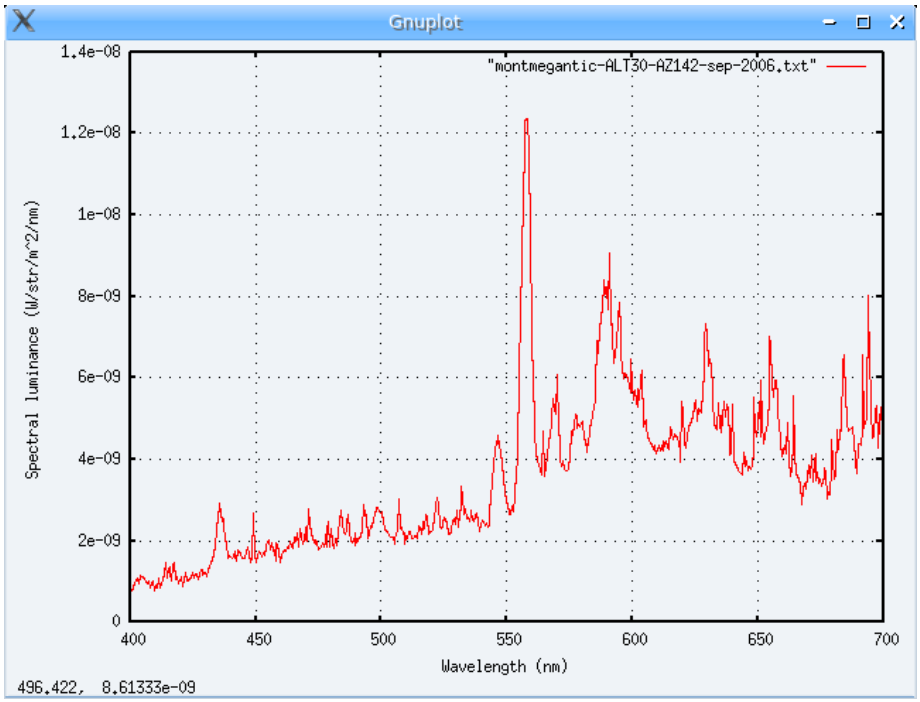
Measure at zenith



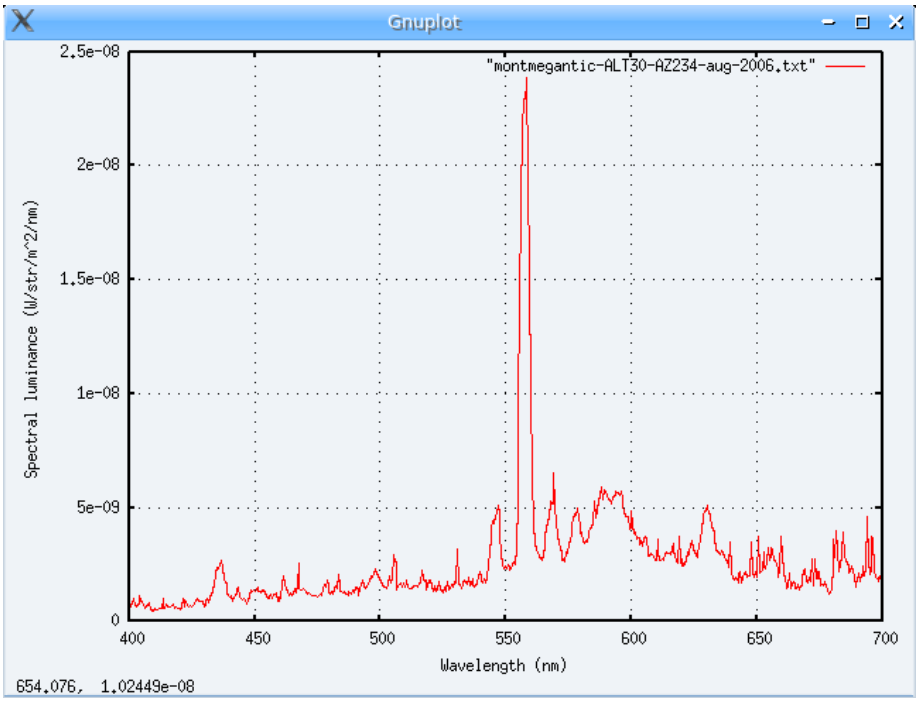
Measure in direction of Lac-Mégantic



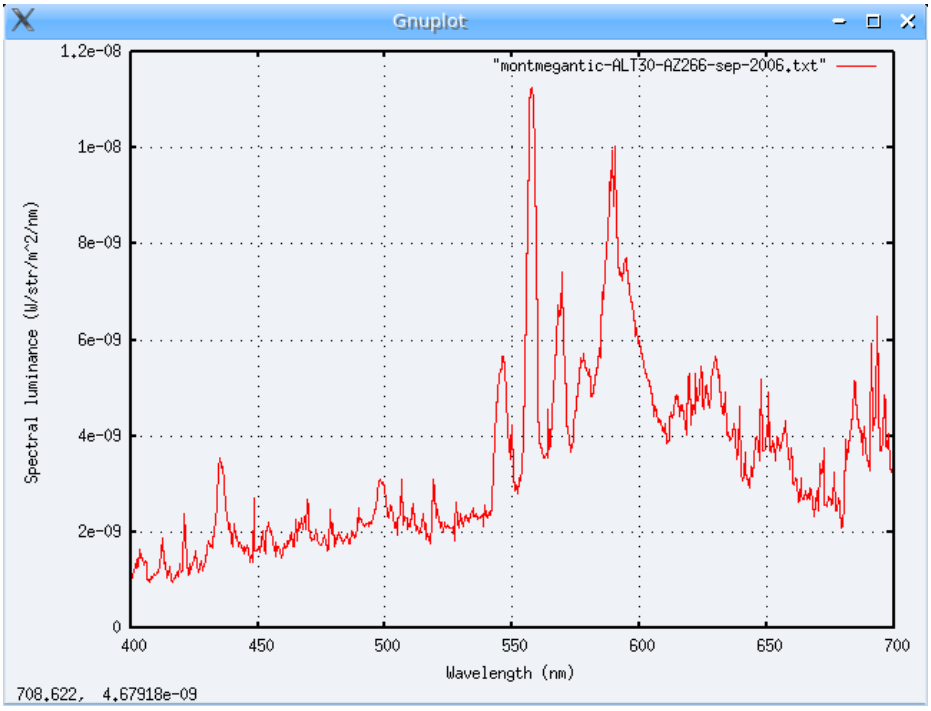
Measure in direction of Notre-Dame-des-Bois



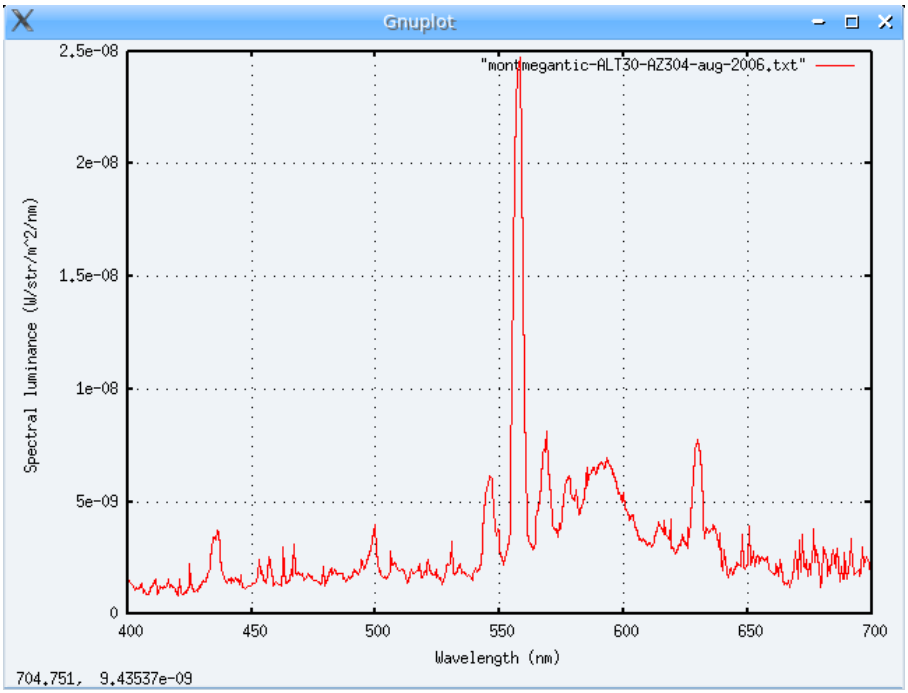
Measure in direction of La Patrie



Measure in direction of Sherbrooke



Measure in direction of Scotstown



5 SUMMARY OF ACTIONS SINCE 2003

5.1 Awareness and education

Back in 2003, the population of Eastern Township and of the Province of Quebec had almost never heard about light pollution problems. There were exceptions however in some municipalities around the Mont Mégantic and for some astronomers but the little awareness done had not given any results: light pollution was still growing and local population wasn't much engaged in protecting the night sky. The first part of the Action Plan was to develop a strong program of awareness and education that is summarized below. After 4 years of hard work, everywhere in the Eastern Township County, most people are aware of the light pollution problem: Light Pollution is now a common expression! Eastern Township medias are covering regularly the evolution of this project.

5.1.1 General population

The best way to reach general population is through media coverage. Since the beginning of the project, over 50 radio interviews, 60 articles in newspapers and magazines and 15 television stories were made at the local, regional and national levels. **See Appendice A**. Scientific television show " Découvertes" diffused at Radio-Canada national television will do a specific topic on the Mont-Mégantic's project. It will be diffuse in late September of this year.

Moreover to this media coverage other awareness strategies were put in place such as:

- many articles were published trough municipal information;
- a calendar of the OMM is sent every year to a wide range of people (politics, professionals, industries, stores, …);
- a pamphlet was distributed to all doors of first zone;
- a sticker is offered to all complying properties.

Sticker offered to all complying properties

Phamplet

Also, every visitor that comes to the ASTROLab is informed about problems caused by light pollution **through educational activities offered all year long** and trough:

- Web site: www.astrolab.qc.ca
- Web site: Canada under the stars, www.astro-canada.ca
- Park's Journal
- …

5.1.2 Municipalities, MRC's and Eastern Township

In order to get the regulation adopted, municipalities had to be informed about all issues of the project and accept the proposed regulation. Without their support, this project couldn't have gone so far. Numerous presentations have been given at different time in both MRC (mayors council) and in most of the 32 municipalities to present and explain the project, the regulation and the conversion project.

Also, a specific working committee is in place with Sherbrooke city since 2003 to make sure the regulation process would go promptly. Moreover presentations were made to different political committee (mayor, urbanism, sustainable development). The Sherbrooke City committee on light pollution is formed of:

- Chief of Urbanism Division
- Chief of Inspection Division
- Chief of Hydro-Sherbrooke, Roadway lighting Division
- Chief of Building and Parks

The Sherbrooke's committee has developed its own action plan that was adopted by the municipal council in 2004.

Although the process was long, the municipalities and the MRC are presently well involved! All Eastern Township is getting more and more involved. Some other municipalities/MRC from other regions of the province have also express interest in adopting the same types of regulations.

In addition, a new "Chart for Protection of Eastern Township Landscapes" includes the protection of starry night! **See Appendix B.**

5.1.3 Professionals

Once the regulation was adopted, technical presentations were offered to professionals such as:

- Engineering and architect firm
- Electricians
- Electric distributors
- Municipal inspectors
- Municipal urban planners and engineers

After they have received the technical presentation, a "Technical guide on outdoor lighting", written by the ASTROLab was given to them so they could refer to some literature regarding new regulation. **See Appendix D.**

5.1.4 Governments

The third part of the Action Plan was to replace many outdoor lighting fixtures to reduce light pollution and to clearly demonstrate how lighting should be managed in the future. To do so, governmental financial support was needed. To get their attention towards light pollution problems, the energy aspect was the main one to exploit. Some studies were done to show how the situation of outdoor lighting was going through Quebec province.

These studies showed that Quebec is one of the most illuminated areas in the world per capita and it was estimated that the potential energy savings would amount to several hundreds of GWh/yr annually in Quebec. These were presented at various governmental public consultations[1] and this made a clear difference towards the attention given to the project leaded by the ASTROLab by both governments and media.

5.2 Regulation

The regulation process really began in 2004. At first, a review of all existing regulation was made, including California Title24 and MLO Draft. It took more than a year to build a regulation approved by all people implied in the process. The working/reviewing committee was formed of:

- Gilles Meunier, eng., Hydro-Quebec
- Germain Gautiher, IES-MTL, Lumec
- Chrisnel Blot, eng., Spectralux, Lighting laboratories
- Wilbert Simard, IME Experts-Conseil, engineering firm
- Yan Triponez, urban planner, MRC of Granit
- Eric Ladouceur, photometric supervisor, Lumec
- Yvan Dutil, astrophysicist

Once this work was done, MRC and municipalities were able to work on the adoption process with the following results:

- The municipalities of MRC of Granit have adopted the regulation at the beginning of 2005. **See appendix C** for copy of Adoption's resolution (in French).

- The municipalities of MRC of Haut-Saint-François have adopted the regulation at the beginning of 2006. **See appendix C** for copy of Adoption's resolution (in French).

- The City of Sherbrooke hasn't officially adopted the regulation yet due to the "unusual" delay of the New Urban Planning document, that includes the outdoor lighting regulation. However, a Resolution was recently voted by the municipal council to approve an adoption of the regulation this fall. **See appendix C** for copy of Adoption's resolution (in French).

5.3 Lighting fixtures conversion plan

5.3.1 The core: Mont-Mégantic National Park

The core of the Reserve is Mont-Mégantic National Park and Observatory. The National parks owns 4 buildings (excluding shelters) and one Public Observatory. The Professional Observatory owns 2 more building (Observatory and the astronomer's house). In the core, very few lighting installations are in place. They are resumed below.

[1] Parlemantary commission on the " Futur of the energetic security of Quebec's province", Public consultation for a "Sustainable development Law" from Ministry of Sustainable development, Report made for Energy Efficiency Agency of Quebec, Public consultation concerning "Energy security and a new gas-central" at Régie de l'énergie of Québec.

SITE	TYPE OF LAMP	TYPE of FIXTURE	QUANTITY
Parking lot and gate	Low pressure sodium	Full cut-off	5 X 90 watts
Garage	High pressure sodium and motion sensor	Full cut-off and shielded floodlight	1X 70 w HPS 2 X 2 X 60watt incandescent
Buildings	Red CFL's	Full Cut-off or under roofs	many
Circulation Area	Phosphorescent guidance		many

Public Observatory (left) where guidance is used to ensure public security and ASTROLab building (right) where red compact fluorescent are used

5.3.2 Zone 1

The key objectives of the project are to reduce **the total light pollution by 25% and gain a minimum of 1 300 000 kWh/yr energy savings**. Following the success in achieving awareness, education and regulation, the lighting fixtures conversion project was ready to be implemented. However we had to find appropriate financial support to help owners and municipalities. Many efforts to get the necessary funding have been made since 2003 with good results. In total, the ASTROLab has gathered 1.4 millions $CND to fund the project. Financial support is provided as follows:

- Hydro-Québec (500 000$)
- Natural Resources of Canada (250 000$)
- Municipal Affairs of Québec (100 000$)
- Eastern Township Council (100 000$)
- Montréal, McGill and Laval Universities and Mont-Mégantic Observatory (65 000$)
- Mont-Mégantic National Park (75 000$)
- Municipalities, industries, stores, residential owners, … (310 000$)

The conversion project includes the replacement of 2500 lighting fixtures within the 16 municipalities closest to the Observatory. Over 500 sites are being visited in all sectors of activities (industries, roadway, individuals, farms,...).

As of the 30th of June 2007, the following results, representing approximately 60% of the conversion project, are pretty conclusive:

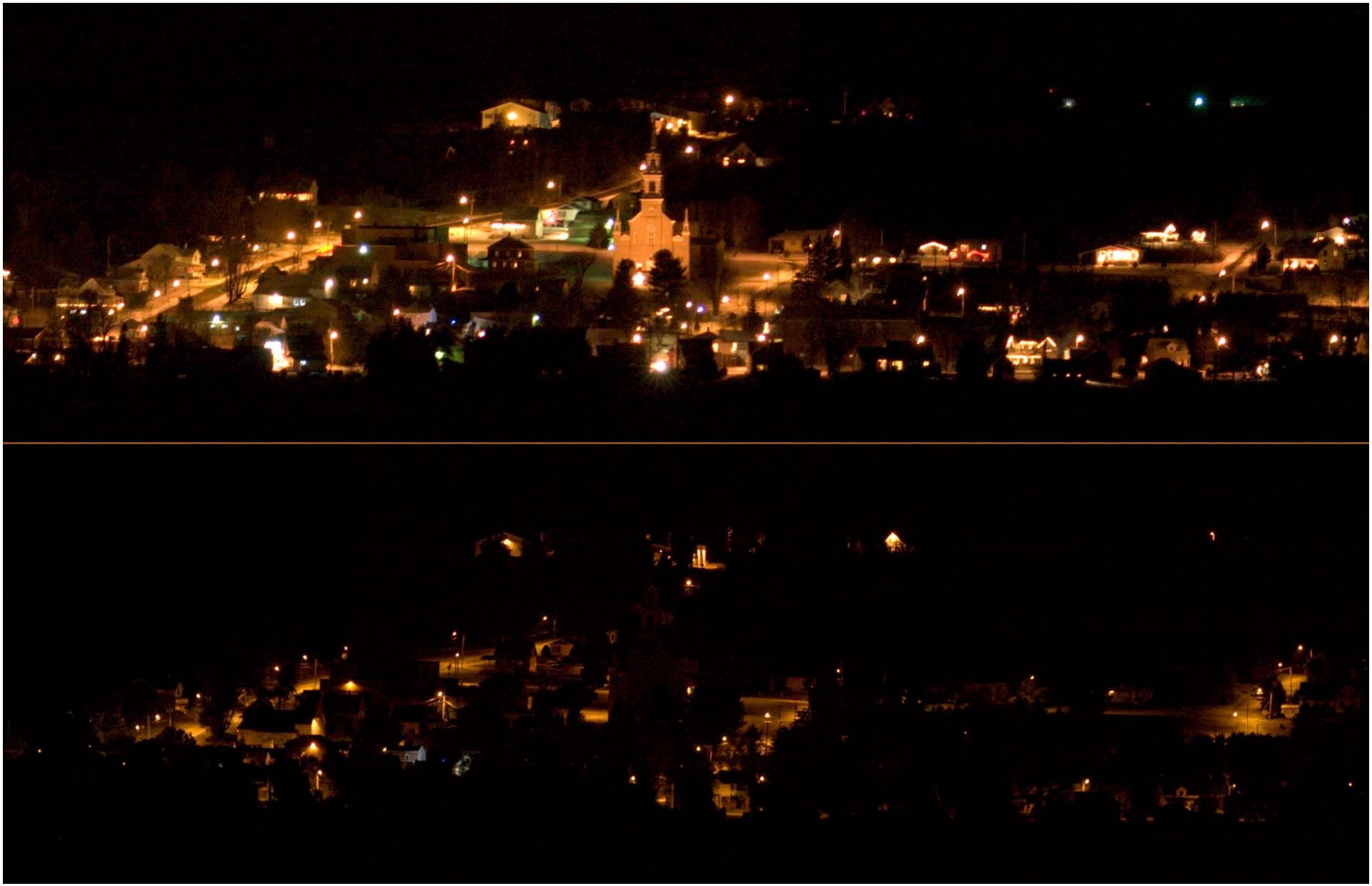
- 318 sites visited;
- 709 lighting fixtures replaced by 632 shielded ones in non-roadway installations
- 1020 roadway lighting fixture replaced in 7 small municipalities and in Lac-Mégantic city
- Gain of 50% in energy consumption for roadway lighting;
- Gain of 80% in energy consumption for private lighting;
- 995 000 kWh/yr energy savings;
- Light pollution measures will be made by the end of 2007, but great comments have been made by local population and astronomers:

" We no longer see light dome over municipalities when it's cloudy… I now have to get back to my hold habits and use my flashlight when I walk around the Observatory… It's just amazing! "

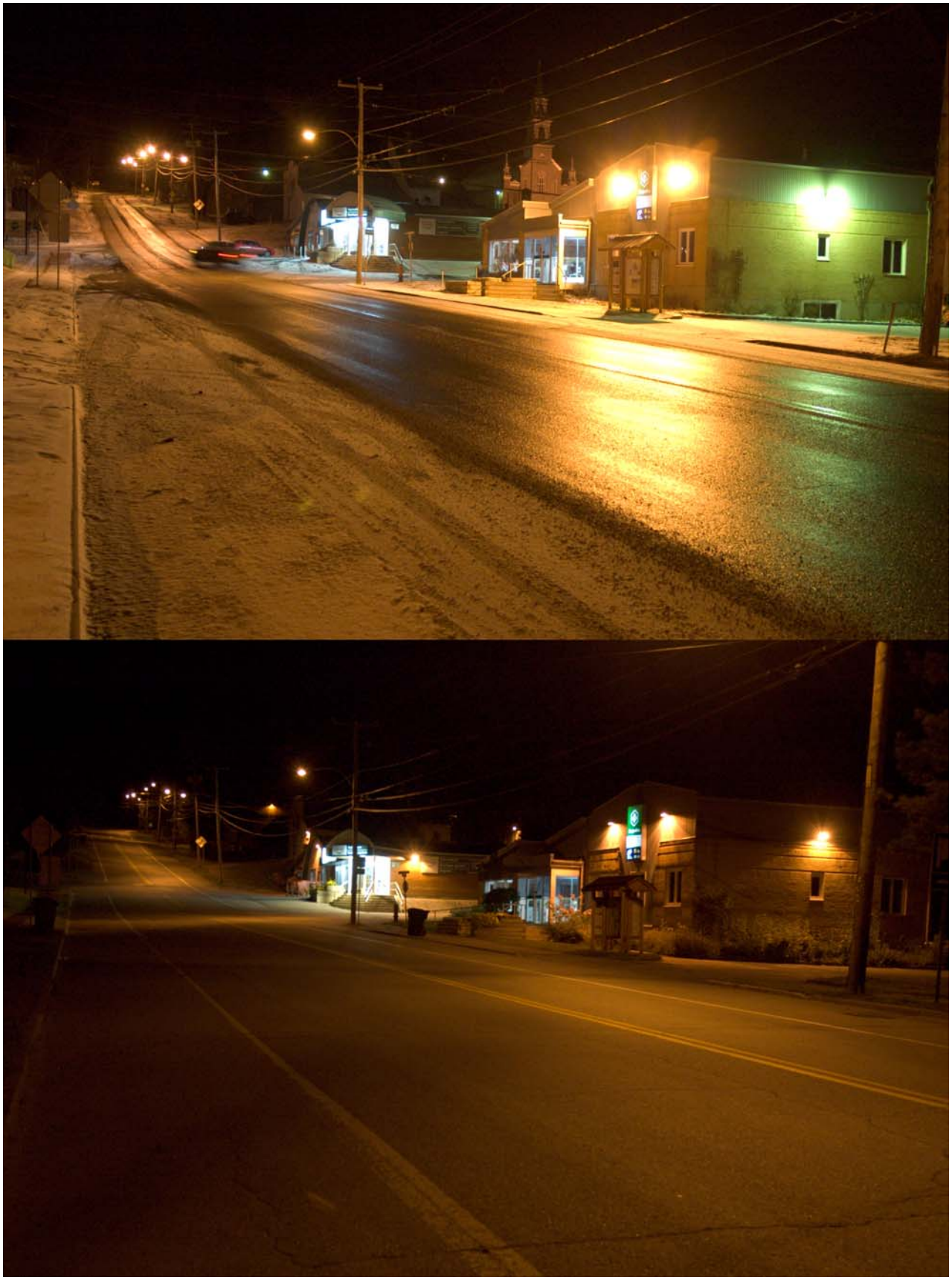
Bernard Malenfant, technician of the Mont-Mégantic Observatory since 1975, founder and president of Mont-Mégantic ASTROLab

This Farm has replaced 5 Dusk-to-Dawn mercury vapour by 5 new high pressure sodium FCO Wall-Pack

These pictures taken by Guillaume Poulin are from La Patrie Municipality before and after the conversion of most lighting fixtures in the community



These pictures taken by Guillaume Poulin are from the main street in La Patrie Municipality before and after the conversion



These pictures taken by Guillaume Poulin are from "Ditton Industries" in La Patrie Municipality before and after the conversion

5.3.3 Zone 2 and 3

Outside this "priority conversion zone", many other actions are being put in place to reduce light pollution. For example, in Sherbrooke city, known as zone 3:

- Hydro-Sherbrooke has a plan to retrofit many roadway lighting installations in the next few years by Dark Sky Friendly ones moreover to reduce overlighting. They have already retrofit (or add in some case) 550 lighting fixtures by dark sky friendly ones. In addition, they have stopped installing 400 watts fixtures and are now using mostly 100 and 150 watts and some 250 watts instead;

- Even if regulation were not yet adopted at the beginning of the project, many preventative actions were put in place by Lac-Mégantic and Sherbrooke cities. As examples, Wal-Mart and MAXI's grocery store in Sherbrooke have mostly respected the proposed regulation upon city's request!

- New car dealers installation, grocery stores, parking lot, new buildings of Sherbrooke city are respecting new regulation by using appropriate lighting fixture, lighting level and curfew;

- The University of Sherbrooke will replace all their non-conforming outdoor lighting fixture by the end of 2008 (about 150 units);

- The Quebec Ministry of Transportation has also replaced many of their roadway lighting fixtures in the Mont-Mégantic Area and Sherbrooke city and their new installation are respectful of the regulation adopted by municipalities.

Here's an example of new Ministry of Transport's roadway installations

Good lighting fixture, HPS lamps, appropriate lighting level

Sherbrooke's New Wal-Mart (2005)

Good lighting fixture, reduced lighting level (about 25 lux)

Sherbrooke's New MAXI'S Grocery Store (2005)

Good lighting fixture, HOS lamps, reduced lighting level (about 30 lux)

Lac-Mégantic Hospital (2004)

Good lighting fixture, reduced lighting level (about 10 lux)

6 LONG TERM ACTION PLAN

Of course, the regulation represents the ideal legislative structure to ensure good lighting installations for years to come. But everyone knows regulation is not a guarantee of success if it's not well applied, monitored and enforced. In addition, the population needs to be reminded constantly of its existence and the importance to respect it. Although, the visibility of the Mont-Mégantic Area in its activities of education and tourism in astronomy will help maintain the focus on preserving the night sky, the following actions will also help maintain the focus:

- In addition to all the activities related to Starry Nights and light pollution problems offered to the general public, Mont-Mégantic National Park Administrators are involved with all surrounding communities through their presence on the following Boards of Directors:
    - Local Development Center (tourism, culture, industry) of Granit and Haut-Saint-François Municipal Regional County;
    - Eastern Township Tourism;
    - Harmonisation Table of Mont-Mégantic Area (Committee specifically dedicated to maintain sustainable development and good relation between communities and National Park organisation);
    - ASTROLab Coorporation.

- The Mont-Mégantic Observatory Administrator and researcher are directly concern by the protection of their Dark Sky. They will have the measurement program under their supervision and have some funds for awareness every year. They are also part of the ASTROLab Corporation Board of Director and closely related to the National Park Adminitrators.

- Sherbrooke's College Administrators and Dr. Aubé research team are planning a new Research Center dedicated to the light pollution studies (Sky Glow measurements and models, Ecology and Human Health). Educational program and Scientific Publications are part of their interrelated missions. In addition to the research program, a great example of what may be developed through this academic institution, is a new course about all light pollution issues and outdoor lighting design who will be offered to graduate and undergraduate students and to professionals (electrician, municipal inspectors, engineers,…) of Eastern Township Area and other surrounding County. This center should be operational by 2009.

- Finally, all local leaders, regional development center, environmental groups, governmental regional agencies are already involved and believe Mont-Mégantic installations/activities are part of their economic development, of sustainable development tendencies and represent an important area to protect for the benefit of all population.

Event tough it was impossible to join all document related to the protection of Starry Nights or outdoor lighting guidelines, requirements, protocols,… written during theses last four years, we hope that the information contained in this nomination package demonstrates to the IDA Board of Directors the long term viability of the project in regaining and protecting the night sky for the future.

APPENDIX A: EXTRACT OF MEDIA COVERAGE

Le dimanche 28 septembre 2003 L'ÉCHO DE FRONTENAC A-3

La menace d'éteindre le ciel en l'éclairant trop

La pollution lumineuse a doublé depuis 20 ans

Les scientifiques appréhendaient la menace, mais pas à un tel rythme. Aujourd'hui, ce ne sont plus seulement les tracteurs de ferme, au bas de la montagne, qui dérangent les travaux de recherche à l'Observatoire du Mont-Mégantic mais un ensemble d'activités humaines. Résultat, depuis vingt ans la pollution lumineuse a doublé. Des millions de dollars en énergie gaspillée en pure perte à éclairer le ciel, la nuit. «*Le Québec est le pire pollueur lumineux au monde*», tranche Chloé Legris, un nom prédestiné pour celle qui doit mener à bien le projet de lutte contre la pollution lumineuse dans la région du mont Mégantic.

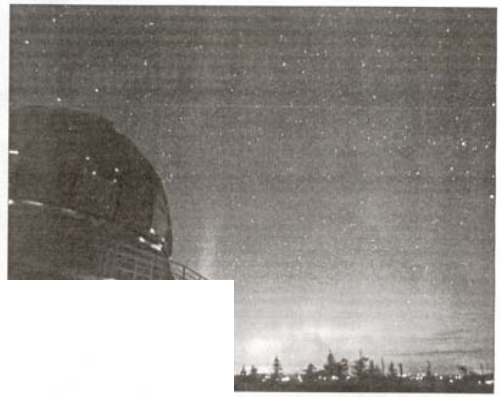
Rémi **TREMBLAY**

Si les astronomes passent des nuits blanches à scruter le ciel noir, au même moment, dans les villes comme dans les campagnes, on s'ingénie à illuminer tout azimuth, certains par souci de sécurité et d'autres pour une meilleure visibilité de leur place d'affaires, avec pour résultat que le ciel étoilé de la région du mont Mégantic a perdu de son lustre.

Dur constat pour le personnel de

les particules présentes dans l'atmosphère, elle est réfléchie vers la Terre, augmentant ainsi la brillance du fond du ciel.» Voilà pour l'explication de la problématique, tel qu'exposée dans le document publié en août dernier pour dévoiler le plan d'action proposé dans la lutte contre la pollution lumineuse.

Pour le président de la Fédération des astronomes amateurs du Québec, Rémi Lacasse, la protection du ciel nocturne devient une priorité straté-



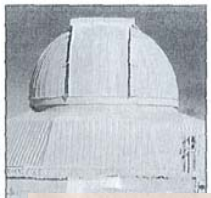
une vingtaine d'étoiles visibles», alors qu'il fut une époque

Environnement

Sauvons nos étoiles!

Les conséquences de la pollution lumineuse

Éclairer l'extérieur d'une maison n'est pas très écologique. Ça pollue le ciel et si tous les Québécois faisaient de la sorte nous aurions besoin de six Baie-James. Consommons plus écologiquement.



La lumière projetée directement vers le ciel et réfléchie du sol vers le ciel contribue à augmenter la brillance du fond du ciel, limitant ainsi notre accès à un ciel étoilé. Dans les sociétés industrialisées, la pureté d'un ciel noir laisse place désormais à un ciel opaque et grisâtre. Selon le premier Atlas (1) de la pollution lumineuse, environ 97 pour cent de la population nord américaine et européenne vit sous un ciel lumineusement pollué.

Toute cette lumière perdue vers le ciel, pénétrant dans nos maisons (lumière intrusive) ou éblouissante, appelée «pollution lumineuse», met non seulement en péril l'observation des étoiles et les recherches en astronomie mais porte atteinte à l'équilibre des écosystèmes et génère d'importantes pertes d'énergie.

Que se passe-t-il quand la nuit n'est plus noire?

Les études menées à ce jour dé-

decine affirme que le dérèglement de l'horloge interne causé par l'éclairage artificiel s'avère un facteur aggravant des risques de cancer du sein.

Également, la clarté des villes contribue à affaiblir la capacité d'adaptation de l'oeil humain à la noirceur en plus d'être une cause des troubles de sommeil associés aux grandes villes.

Quant aux biologistes et aux environnementalistes, ils s'entendent pour affirmer que l'éclairage nocturne a des conséquences notables auprès de plu-

le reflet des étoiles ou de la lune sur la mer;

- certaines espèces peuvent déserter complètement une région puisqu'elles fuient les zones artificiellement éclairées la nuit.

On connaît encore trop peu l'impact de l'éclairage artificiel sur la santé humaine et les écosystèmes, mais une chose est certaine; la vie a besoin de nuit.

Ce sont là quelque-unes des conséquences liées à l'utilisation abusive de l'éclairage, afin de mettre en perspecti-

La MRC du Granit est la première à réglementer en faveur du ciel étoilé!

Le dimanche 22 mai 2005 L'ÉCHO DE FRONTENAC A-3

Réglementation pour contrer la pollution lumineuse

La MRC du Granit réalise une première

C'est dans le but de préserver le ciel étoilé de la région et du même coup les recherches en astronomie effectuées à l'Observatoire du mont Mégantic que la MRC du Granit a adopté, le 23 mars, une nouvelle réglementation sur l'éclairage extérieur, laquelle devrait entrer en vigueur à la fin du mois. Une première qui pourrait bien servir d'exemple à l'échelle du Québec.

Claudia **COLLARD**

Ces modifications au règlement de contrôle intérimaire en vigueur depuis janvier 1995 concernent 19 des 20 municipalités de la MRC, seule celle de Saint-Robert en étant exclue. Cette nouvelle version a été élaborée de concert avec l'AstroLab du Mont-Mégantic et comprend des normes visant l'éclairage inclues dans le schéma d'aménagement révisé.

En plus de préserver la qualité du ciel, cette réglementation vise à favoriser l'efficacité énergétique, assurer tant une bonne visibilité qu'un environnement sécuritaire et mettre l'accent sur une lumière douce et bien contrôlée, qui ne soit ni éblouissante, ni intrusive.

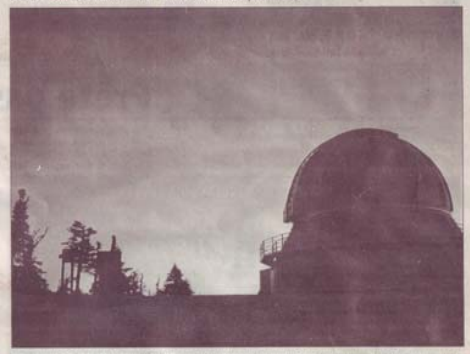
«*Cinquante pour cent de la pollution lumineuse est concentrée dans un rayon de 25 km à partir du mont Mégantic, 25% entre 25 et 50 km et 25% provient de Sherbrooke*», informe Yan Triponez, aménagiste de la MRC du Granit. Aussi, des réglementations similaires devraient être prochainement adoptées par la MRC du Haut-Saint-François et la ville de Sherbrooke.

Sur le territoire de la MRC du Granit, les dispositions varient selon qu'on se trouve dans la zone environnementale 1 (Frontenac, Lac-Mégantic, Marston, Milan, Notre-Dame-des-Bois, Nantes, Piopolis, Woburn, Stornoway et Val-Racine) ou 2 (Audet, Courcelles, Lac-Drolet, Lambton, Saint-Ludger, Saint-Romain, Sainte-Cécile, Saint-Sébastien et Stratford). Les sources lumineuses acceptées sont un peu plus restrictives dans la première zone. Par exemple, les fluorescents y sont interdits tandis qu'on les accepte pour les enseignes lumineuses dans la zone 2. À noter cependant que tout équipement installé avant l'adoption de la réglementation bénéficie d'un droit acquis.

Une disposition s'applique toutefois à l'ensemble des institutions, industries, commerces et propriétés agricoles, à savoir l'extinction de tout dispositif d'éclairage dès 22h00 (ou hors des heures d'affaires ou d'opération), pour ne préserver que l'éclairage dit sécuritaire.

«*Si on veut assurer la sécurité d'un site durant la nuit, on peut toujours installer un détecteur de mouvement*», illustre Chloé Legris, chargée du projet à l'AstroLab depuis 2003. «*Il ne s'agit pas de ne plus éclairer mais d'éclairer mieux, en utilisant des luminaires adéquats qui ne projettent pas de lumière vers le ciel, en évitant les excès de luminosité, en favorisant des lampes au sodium*», partage-t-elle. Les sources au mercure sont notamment interdites dans la nouvelle réglementation.

Des actions de sensibilisation afin d'encourager la conversion volontaire des installations inadéquates seront menées au cours des prochaines semaines. Mme Legris tient par ailleurs des rencontres et de la formation avec les électriciens, les distributeurs de produits d'éclairage, les ingénieurs et les architectes de la région.



La nouvelle réglementation sur l'éclairage extérieur vise notamment à préserver les recherches en astronomie effectuée à l'Observatoire du mont Mégantic. (Photo S. Giguère)

nière au Québec à adopter une
e extérieur. Elle veut ainsi pré-
vatoire du Mont-Mégantic, qui
our l'observation des étoiles et

ve la croissance de la pollution
ie trouvera aussi à créer une des
toilé.
vigueur vers la fin du mois de
neuses, les luminaires, la quan-
ares d'opération des dispositifs

-Mégantic et la MRC du Granit
ener des actions de sensibilisa-
ion volontaire des installations
ons.

tion avec des électriciens, des
ge, des ingénieurs et des archi-
t.

nentaire, on peut joindre Chloé
ojet à l'ASTROLab, au numéro
8, ou Yan Triponez, à la MRC

Sherbrooke fait de gros efforts pour réduire la pollution lumineuse

David **Bombardier**
SHERBROOKE

La Ville de Sherbrooke ne pourra adopter son règlement sur la pollution lumineuse cette année, mais elle fait tout de même de gros efforts pour réduire l'éclairage sur son territoire.

Le règlement dont veut se doter la Ville devait être intégré au nouveau plan d'urbanisme, mais l'adoption de ce dernier est retardée jusqu'en 2006. En attendant, l'administration Perrault limite la pollution lumineuse lorsqu'elle approuve de nouveaux projets commerciaux nécessitant des plans d'implantation et d'intégration architecturale (PIIA).

Exigé si possible

«Chaque fois qu'on peut l'appliquer, on le fait», assure le chef de la division de l'urbanisme, des permis et de l'inspection de la Ville de Sherbrooke, René Girard.

Les commerces du plateau Saint-Joseph (Wal-Mart et bientôt Canadian Tire et Home Depot), le Maxi & Cie du boulevard de Portland et le nouveau concessionnaire Mazda du boulevard Bourque ont tous dû se soumettre aux nouvelles exigences de la Ville. Leurs lampadaires sont notamment orientés vers le sol plutôt que vers le ciel. L'intensité des lampadaires est aussi réduite de moitié, voire des deux tiers.

Ces nouvelles règles en matière d'éclairage sont aussi de plus en plus respectées par les différents services de la Ville, entre autres lorsque vient le temps d'installer de nouveaux lampadaires dans les rues. Dès l'an prochain, tous les gens d'affaires devront respecter ces règles lorsqu'ils voudront modifier l'éclairage de leurs commerces à Sherbrooke.

Plus sécuritaire

«Comme l'intensité des lampadaires est moindre, ça coûte beaucoup moins cher en électricité et c'est moins éblouissant, donc plus sécuritaire en bout de ligne», mentionne M. Girard.

Ce dernier ajoute que les Québécois ont tendance à exagérer l'intensité de l'éclairage extérieur en raison du faible coût de l'électricité. Des images satellites, dit-il, ont déjà démontré que le halo de lumière au-dessus de Montréal est comparable à celui de New York, la principale agglomération des États-Unis avec 21 millions d'habitants.

La pollution lumineuse complique passablement la vie des observateurs d'étoiles, en particuliers les scientifiques de l'ASTROLab du mont Mégantic. L'absence d'obscurité aurait également un impact sur les troubles du sommeil ainsi que la migration de certaines espèces d'oiseaux, d'insectes et de papillons, ce qui viendrait ébranler la chaîne alimentaire dès ses premiers maillons.

AL LUNDI 4 OCTOBRE 2004 ACTUEL

VIRONNEMENT

Les étoiles en voie de disparition

ent

JEAN-PHILIPPE FORTIN
COLLABORATION SPÉCIALE

«J'habite la Rive-Sud, explique au téléphone l'astronome Pierre Bastien, directeur de l'Observatoire du mont Mégantic (OMM). Au milieu des années 80, au sud de l'autoroute 30, je pouvais voir très bien le ciel avec une simple paire de jumelles. J'y suis retourné, et ce n'est plus possible. Par expérience, ça s'est probablement dégradé de

PHOTO DENIS COUVRETTE, ARCHIVES LA PRESSE

'installe avec une chaîne stéréo
ans sa cour n'aura pas la même
pproche que s'il posait un système
'éclairage », illustre Rémi Lacasse.
ourtant, la lumière, comme la mu-
ique, se rend chez les voisins.
Et ils sont parfois à 100 km : en
ontérégie, celle de Sherbrooke
lit... de l'ombre à l'OMM. Celui-
i, l'AstroLab et le Parc du Mont-
égantic, ont entrepris une campa-
ne de protection du ciel noir. On
spère renverser la vapeur, expose
ierre Bastien, d'ici 2010. On dis-
ute avec les MRC des alentours,
vec la ville de Sherbrooke et on
t optimiste. « Les gens sont sou-
ent mal informés, ils ne veulent
as mal faire, mais ils ne savent pas
e qu'ils font. »
Comme disent les Chinois,
l'ignorance est la nuit de l'esprit.
cette nuit n'a ni lune ni étoiles. »
Hubert Reeves se dit certes inquiet, mais constate qu'il y a des progrès : « Je vois avec le Symposium que la première étape, la prise de conscience, se fait et de plus en plus. »
« Le ciel est un bout — immense — de nature inaliénable et d'avoir ciel en ville, ce serait aussi important que le parc en ville, rerend Philippe Poullaouec-Gonidec. Le ciel est aussi spectacle, ce 'est pas que des étoiles figées. » penser aussi aux aurores boréa-
les et aux nuits d'étoiles filantes.

roenland
rait

résidants de Llulissat,
de la côte Ouest du
d députée pour la majes-
icebergs, ont avalé leur
travers en apprenant la
dans le journal : l'atrait
de leur ville fond à vue
e journal *Groenlands Pos-*
vait comment le glacier
Kujalleq, un des plus ac-
monde, avait reculé de
cinq kilomètres en deux
moyenne de sept mètres

Des sommes astronomiques

Le comité Ciel noir de la Fédération des astronomes planche sur une campagne de sensibilisation. Son argument massue : celui des sous. Et c'est le cas de le dire, on parle de sommes astronomiques.

En effet, en matière d'efficacité énergétique, l'éclairage nocturne ne... brille pas parmi les meilleurs. « Selon l'International Dark-Sky Association (IDSA), le tiers de l'énergie utilisée à des fins d'éclairage externe est perdue », souligne M. Lacasse. Bin fait, 30 % de la lumière d'un lampadaire illumine carrément le ciel, alors qu'un abat-

vers. » En consultant le programme du symposium, on ne peut que lui donner raison : la nuit recule partout.

Et « cela perturbe énormément la vie animale, on le voit dans les migrations des oiseaux par exemple », rappelle Hubert Reeves. Lors du symposium, la Ligue ROC, une association française de protection de la faune, présentait une synthèse sur ce sujet. Hubert Reeves en est le président. En fait, le rythme circadien (l'alternance du jour et de la nuit) influence de façon déterminante l'horloge biologique de la faune et de la flore, et joue égale-

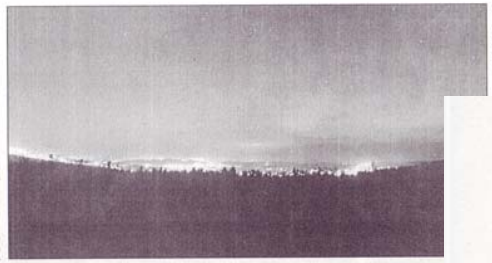
POLLUTION LUMINEUSE PAR AGGLOMÉRATION

Agglomération	Population	GW*h/an	M$/an
Montréal	3 127 000	245	15
Québec	646 000	80	5
Chicoutimi	161 000	20	1,2
Trois-Rivières	136 000	16	1,0
Ensemble du Québec	7 300 000	760	45

*Gigawatt
Source: Qui a volé les étoiles ? Yvan Dubé et FAAQ.

Les nuits étoilées en voie de disparition

L'ASTROLab et la Ville de Sherbrooke s'attaquent à la pollution lumineuse



Courtoisie, Ré

L'ASTROLab caresse l'idée d'un programme de conversion des lampadaires pour les palités se trouvant dans un rayon de 25 km de l'observatoire. Sherbrooke, que l'on ici, fait quant à elle figure de pionnière grâce à la politique qu'elle doit adopter pour la pollution lumineuse.

Legris.

Depuis 10 ans, l'ASTROLab tente de sensibiliser la population locale, mais ce n'est pas suffisant pour tenter de créer une réserve de ciel étoilé, l'objectif que caresse l'organisme.

Depuis plus d'un an, l'ASTROLab met les bouchées doubles pour s'attaquer au problème, notamment grâce à l'implantation de son plan d'action. Celui-ci met en scène divers intervenants, des électriciens en passant par les ingénieurs.

Dans la foulée, Sherbrooke aura sa propre politique dans le domaine, ce qui en fera une nationale. Avec cet outil, la Ville compte les règles régissant l'éclairage extérieur d les implantations commerciales. Les actio tes ont déjà commencé; on tente en effet des luminaires moins polluants, entre aut

Selon Mme Legris, pour préserver u toire astronomique, la superficie sur la intervenants posent leurs actions s'avère démarches les plus importantes du proces TROLab caresse notamment l'idée d'un p de conversion des lampadaires pour les

tés se trouvant dans un rayon de 25 km de l'observatoire. Il n'y a donc pas que Sherbrooke qui sera mise à profit: les MRC du Granit et du Haut-Saint-François aussi. «On ne veut pas juste prévenir, on veut diminuer l'éclairage. On veut aller chercher des subventions. On est conscient que ça va être fait sur une base volontaire, alors ça va prendre des incitatifs financiers...»

Il y a quelques années, dit-elle, elle parlait de ce sujet et les gens la regardaient «avec des yeux gros comme des deux nia-

problème est ailleurs.

Pour beaucoup d'Européens, en effet, il est carrément question de greffer au continent ce qu'ils refusent de voir autrement que comme un corps étranger. C'est-à-dire : une na-

nantie qui se perçoit elle-même comme fermement engagée sur la voie de la démocratie, des droits, de l'ouverture et de la modernité.

La réaction, en Turquie et ailleurs, pourrait être carrément dévastatrice.

PAR LUC CHARTRAND | UNSIÈCLEFOU

La (re)conquête des étoiles

La nuit moderne ne connaît plus l'obscurité et les étoiles ont disparu du ciel. La lutte contre la pollution lumineuse est-elle le dernier champ de bataille de l'environnement?

Dans un colloque récent sur la protection des paysages tenu à Sherbrooke, un intervenant a fait sourire l'assistance en proposant de lutter contre la... «pollution nocturne».

Un consensus s'est plutôt établi autour de l'idée d'envoyer la «pollution lumineuse»... Un groupe associé à l'ASTROLab et à l'Observatoire astronomique du mont Mégantic veut même transformer la zone environnante en une «réserve de ciel étoilé»! Cette région est en effet un des endroits où la nuit est la plus noire dans la partie habitée de l'est de l'Amérique.

Notre civilisation a oblitéré les étoiles. Ces partisans de l'obscurité veulent les reconquérir!

Cet été, la majorité des urbains que nous sommes a pris la clé des champs – à la mi-août, il ne faudra pas manquer d'aller admirer les Perséides – et, le soir, devant la tente ou le chalet, s'est probablement émerveillée de la quantité d'étoiles que compte le ciel. Au mont Mégantic, on peut en apercevoir plus de 3 000; à Montréal, à peine une trentaine.

Cette différence est attribuable à la pollution lumineuse, c'est-à-dire le réfléchissement dans l'atmosphère d'une luminosité créée au sol par la lumière artificielle. L'intensité de ce réfléchissement croît à grande vitesse et menace même des régions jadis épargnées: en 1999, des chercheurs ont calculé que l'indice de brillance du ciel avait doublé autour de l'Observatoire du mont Mégantic depuis sa construction, 20 ans plus tôt. Si la tendance se maintient, le site pourrait perdre sa pertinence scientifique, car on ne pourrait plus y effectuer certaines observations en raison du voilage des étoiles. D'où

L'OBSERVATOIRE DU MONT MÉGANTIC POURRAIT PERDRE SA PERTINENCE SCIENTIFIQUE, CAR ON NE POURRAIT PLUS Y EFFECTUER CERTAINES OBSERVATIONS EN RAISON DU VOILAGE DES ÉTOILES.

Luc Chartrand est journaliste pour l'émission Zone libre, à Radio-Canada.

Sherbrooke – l'agglomération la plus proche –, son étalement constitue la plus grande menace à une réserve de ciel étoilé. Comme la plupart des formes de pollution, celle par la lumière découle de pratiques et de commodités avantageuses pour les gens qui en font usage, et auxquelles on ne renonce pas facilement. Là comme ailleurs, la solution ne peut venir que des compromis: il ne s'agit pas d'éteindre toutes les lumières, mais d'en diminuer la quantité, d'en changer l'orientation (30% de la totalité de la lumière produite artificiellement se dirige vers le ciel) ou d'adopter des ampoules moins polluantes (la lumière blanche produit plus de pollution et gaspille plus d'énergie

cette mobilisation contre tons, particules d'énerg neuse que la civilisation g surabondance.

Comme il fallait s'y att sont des astronomes qui o l'alarme. De simples citoy ont emboîté le pas, cons protéger une richesse aussi que les bélugas du Saint «Les enfants des villes n jamais les étoiles», dit Chl chargée de projet à l'ASTR

Un plan d'action cont lution lumineuse, pr l'été 2003, a été bien re conseils municipaux de la y va de l'intérêt touris Haut-Saint-François: «Vi visiteurs se rendent dans chaque année pour partic activités astronomiques.»

Mais il est difficile, pré Legris, de convaincre le teurs d'atténuer l'éclairag qui illumine leurs bâtim la nuit et sert à décourag tuels rôdeurs. Quant à l

Pollution lumineuse: une expertise reconnue

Une équipe du Cégep de Sherbrooke accueillie à bras ouverts par des astronomes américains

Isabelle Pion
SHERBROOKE

Les jeunes chercheurs du Cégep de Sherbrooke, ces «traqueurs» de ciels étoilés, ont été accueillis à bras ouverts par les astronomes des États-Unis, où ils y ont effectué une importante mission. Imaginez: maintenant qu'ils ont mesuré la pollution lumineuse dans d'importants observatoires, ils aideront les scientifiques américains à dresser un portrait de cette problématique.

«Le but du voyage, c'était d'obtenir des mesures de pollution lumineuse sur plusieurs sites importants pour l'observation astronomique», résume en quelques mots Philippe Robert-Staehler, finissant du programme de sciences de la nature et membre de l'équipe. Cette délégation, rappelons-le, fait partie du Graphycs, le groupe de recherche et d'application en physique au Cégep de Sherbrooke.

Non seulement les Américains ont ouvert bien grandes les portes de leurs installations aux Sherbrookois, explique Martin Aubé, professeur responsable du Graphycs, mais en plus ils auraient aimé les garder plus longtemps! En tout, le périple a duré trois semaines et les a conduits en Californie, en Arizona et en Utah, dans des sites aussi impressionnants que le Kitt Peak National Observatory (KPNO), où l'on compte le «plus grand rassemblement d'observatoires» au monde, selon M. Aubé.

Vivre la nuit

Les Américains ont le même problème que nous: en raison de l'étendue des zones urbaines et de la lumière qui prolifère, la survie des nuits étoilées s'avère compromise.

Pendant trois semaines, l'équipe composée de neuf étudiants, d'un technicien et de deux professeurs a recueilli les mesures de pollution lumineuse... la nuit. «Les profs faisaient une nuit sur deux, et les étudiants, eux, une nuit sur trois», explique Nékounita Blanchet, aussi finissante en sciences de la nature. L'équipe a travaillé avec son spectromètre, soit l'appareil le plus sophistiqué pour accomplir cette tâche. «Sherbrooke est en train de se construire une réputation, explique M. Aubé. Le seul autre appareil qui ressemble à celui que l'on utilise se trouve en Italie. Là-bas, tout le monde disait qu'il était supposé exister, mais personne ne l'a vu!»

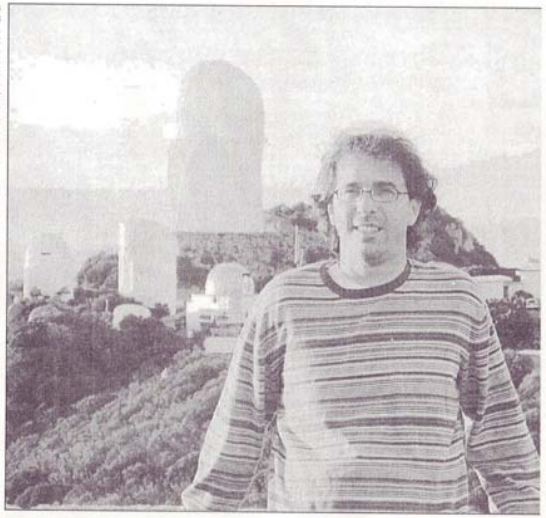
Maintenant que les données ont été recueillies, celles-ci devront être analysées. «À court terme, on veut dresser un tableau de la situation», note M. Aubé, soulignant que ses collègues américains comptent sur ce constat pour pouvoir en arriver à des recommandations.

Des étoiles dans les yeux

De retour depuis quelques jours, les chercheurs semblent avoir autant d'étoiles dans les yeux que les cieux qu'ils ont observés! En sabbatique à compter de l'hiver prochain, Martin Aubé aimerait même aller s'établir là-bas un mois ou deux. «On revient avec tellement d'idées que ça prendrait un autre groupe de recherche pour travailler là-dessus!»

Et c'est sans compter toutes les avenues parallèles reliées au projet. Actuellement, des étudiants de génie électrique s'affairent à une nouvelle génération de spectromètre, alors qu'une équipe de l'Université de Sherbrooke planche sur «un observatoire intelligent».

En plus d'avoir acquis un bagage incroyable de connaissances, les membres de l'équipe sont devenus très sensibles au phénomène. Aujourd'hui, lors de promenades, ils s'interrogent même sur les formes des lampadaires et les sortes de lumière! «Les membres de notre famille commencent à trouver ça fatigants!» remarque Philippe avec le sourire.



Le groupe Graphycs gardera des souvenirs impérissables de sa virée aux États-Unis. Ici, le professeur-responsable Martin Aubé pose devant le télescope de 4 mètres du Kitt Peak National Observatory, où l'on retrouve le plus grand rassemblement d'observatoires au monde.

Montréal, ville lumière...

fcardina@lapresse.ca

FRANÇOIS CARDINAL

Les astronomes sont catastrophés : en 20 ans, la luminosité du ciel entourant l'observatoire du mont Mégantic a diminué de moitié. Si la tendance se maintient, les scientifiques devront plier bagage d'ici 10 ans.

Bien que l'enjeu de la pollution lumineuse puisse sembler trivial, ains auraient tort souci de quelques est en réalité un ironnemental et touche toutes les Montréal en tête. parlent d'eux-mêmu, le halo jaune ivre l'île s'étend à à la ronde. Mont de lumière que elle-même ! Mêavec son Times ilomètres d'édifis à surpasser la coise en terme de use.

l'appétit insatiais pour l'énergie. tricité est si faible nt d'Hydro-Québec à trois fois plus Européen ou un

stat est désolant. core lorsque l'on ron un tiers de la s est dirigée vers majorité des staamericaux de surl'éclairage jusqu'à plus élevé que les ndées.

oût de l'énergie lairer les nuages ns de dollars au nt. Aux Étatsdépasse le mildoit cesser. À -Québec peine à

combler les besoins énergétiques des Québécois et que le Canada s'éloigne à grands pas des objectifs de Kyoto, chaque geste compte.

Dans un tel contexte, il n'y a tout simplement pas de petites économies.

La Ville de Montréal, et le Québec en général, ont du retard à combler pour régler le problème de la pollution lumineuse. Depuis 1992, année où l'Unesco a décrété que le ciel étoilé fait partie intégrante du patrimoine mondial à préserver, de nombreux gouvernements et administrations ont en effet décidé d'agir. Tous se rendent compte aujourd'hui que cela rapporte.

L'ancienne ville de LaSalle, par exemple, a troqué en 1985 plus de 3500 lampadaires au mercure par des luminaires au sodium, moins énergivores. En seulement deux ans, l'investissement était amorti grâce à une nette diminution de la facture d'électricité.

Plus récemment, la Ville de Calgary a elle aussi choisi de remplacer son éclairage routier. Cette seule mesure, prévoit-elle, lui permettra de faire des économies de deux millions de dollars par année en plus de réduire de 40 % les émissions de CO^2 liées à cette source d'énergie.

Pas étonnant, donc, que des lois et des règlements aient été adoptés aux quatre coins du monde, que ce soit en Italie, en Australie, au Chili, en République tchèque ou dans de nombreux États américains, pour protéger le firmament ou diminuer la consommation d'énergie.

Cela dit, il y a, à Montréal, de la lumière au bout du tunnel : le sujet était à l'ordre du jour d'une rencontre à huis clos entre conseillers et fonctionnaires de la Ville, mardi. Il a été décidé d'inclure dans le futur plan d'urbanisme, dont l'adoption est prévue pour le 22 novembre, des mesures visant à réduire la pollution lumineuse.

Le plan d'urbanisme n'étant révisé qu'aux cinq ans, la Ville ne doit pas rater l'occasion d'agir. Et surtout, d'économiser.

VOICI LES NOTES PRISES PAR LES DEUX CANDIDATS PENDANT LE DÉBAT

Actualités

*ASTRONOMIE

Vive la grande noirceur!

Des étoiles disparaissent lentement du ciel du Québec. Au banc des accusés: la pollution lumineuse. Les astronomes ont entrepris de sauver la nuit. Les environs du mont Mégant sont en voie de devenir une «réserve de ciel noir».

par Raymond Lemieux

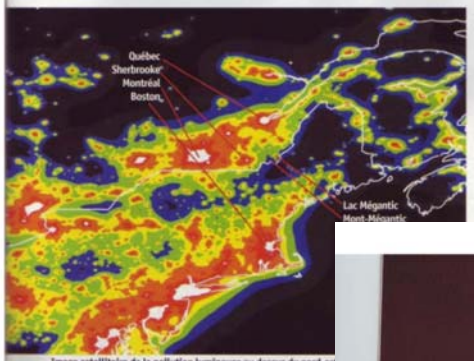


Image satellitaire de la pollution lumineuse au dessus du nord-est par les astronomes en 1997. C'est selon l'échelle dite de Bortle ciel nocturne. En blanc, on estime que l'on peut difficilement con nuit. C'est le ciel de Montréal et de Québec. En noir, on retrouve la lactée est visible comme au sud du lac Mégantic.

Un coin de ciel estrien pourrait devenir la première réserve étoilée de la planète. Les municipalités de la région du mont Mégantic, sur lequel est bâti le plus important observatoire du Québec, ont récemment décidé de réglementer la lumière. C'est une bataille gagnée contre ce que les astronomes appellent la pollution lumineuse.

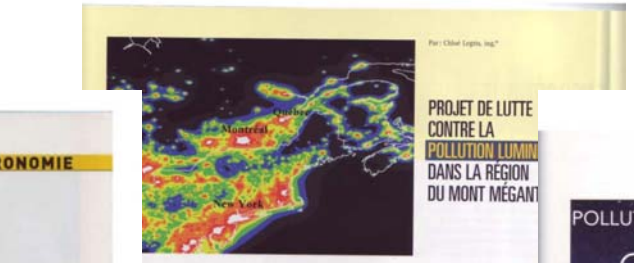
L'astrophysicien Yvan Dutil, chercheur pour ABB, une entreprise de spec-

trophotomètr
un des premi
l'alarme. « Le
du monde le
émet autant d
il. Le plus inq
lution a doubl
j'ai pu étudier
le télescope du
objets difficil
très lointains

fond du ciel. Aujourd'hui, je
plus faire de telles observati
ficacement. » C'est comme s
doté d'un miroir de 1,6 m av

Certains travaux d'obse
bel et bien été abandonn
« visibilité », confirme Chlo
génieure à l'ASTROLab, u
qui fait la promotion de l'as
mont Mégantic. « Il y a
d'étoiles que nous ne pouv
server ! » dit-elle.

À qui la faute ? « Les
d'éclairage, les lampadair
naires, les sentinelles de fern



Par : Chloé Legris, ing.*

PROJET DE LUTTE CONTRE LA POLLUTION LUMIN DANS LA RÉGION DU MONT MÉGANT

an et demi, l'ASTROLab
Mégantic a mis sur pied
le lutte contre la pollution

En vingt ans, la pollution lumineuse a plus que doublé sur le site de l'Observatoire du Mont-Mégantic (OMM), comme un peu partout à travers le monde. L'OMM, un pôle important

La pollution lumineuse : un abus d'éclairage

Dans tous les secteurs d'activités

Pollution lumineuse : Une réserve de ciel étoilé au Mont-Mégantic

mais on ne voit plus les lumières du nord, c'est très joli", constate Bernard Malenfant, technicien du télescope.

Un travail de sensibilisation et d'éducation de longue haleine explique en grande partie

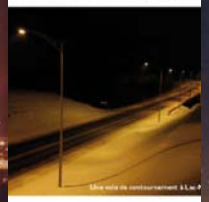
ce succès. Comme le fait remarquer Chloé Legris, "il faut prendre le temps d'expliquer aux gens que lorsque l'on passe d'un lampadaire de 400 W qui envoie la lumière partout à un de 60 W qui est baffé, il y aura une différence, alors ils protestent." Dans

L'observatoire du Mont-Mégantic

nous au-dessus de l'horizon), on a choisi d'exiger une limite stricte sur la quantité de lumière émise directement vers le haut. On sait pourtant que la lumière émise juste au-dessus de l'horizontale pollue trois à quatre fois plus que celle réfléchie par le sol. Il n'a cependant pas été jugé d'avoir zéro émission au-dessus de l'horizon, afin de pouvoir respecter les normes d'éclairage routier sans avoir à supprimer les lampadaires. Cette approche est justifiée par des modèles de diffusion atmosphérique indiquant qu'aux environs de 2 % du flux lumineux au-dessus de l'horizontale, les gains en efficacité d'éclairage amènent une réduction du flux lumineux total qui compromet l'effet de la lumière supplémentaire émise au-dessus de l'horizon. Ainsi, dans la zone située à moins de 25 km de l'observatoire, les lampadaires doivent répondre à moins de 1 % de leur flux lumineux au-dessus de l'horizontale. Dans les autres zones, un faible 2,5 % à condition que la luminosité soit installé à moins de 6 m de hauteur.

Du choix du lampadaire

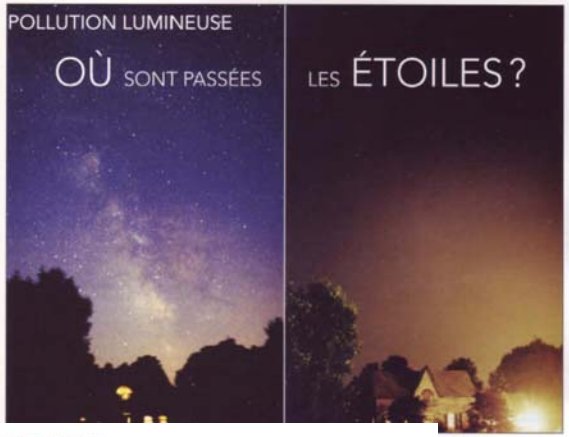
Bien que nombre de régie contre la pollution lumineuse favorisent l'utilisation de luminaires étanches, il est toutefois apparu qu pas toujours favorable du point de l'efficacité énergétique. Par ailleu pérature moyenne par la ville de les indiquent que les lampadai (émettant moins de 0,5 % du flu au-dessus de l'horizon) sont (émettant moins de 5 % du flu au-dessus de l'horizon) sont mieux acceptées par la population environs étoilés situées. Malgré Chloé Legris, la plus grande diffi la disponibilité d'équipements pa dans les magasins grand public peut pas exiger des gens qu'ils a pas s'ils ne peuvent trouver les



Une vue de contournement à Lac-M

POLLUTION LUMINEUSE

OÙ SONT PASSÉES LES ÉTOILES ?



environnement Par Geneviève Rudeau

Quand la lumière nuit à la nuit

On appelle désormais « pollution lumineuse » cet excès d'éclairage nocturne qui, en plus de nous voiler les étoiles, a une incidence négative sur tous les êtres vivants. Nous y compris. Regard éclairé sur une nuit qui l'est tout autant !

En 1880, lorsque la petite municipalité de Wabash, en Indiana, devint la première ville éclairée à l'électricité dans le monde, ses habitants de ne se doutaient sûrement pas qu'à peine 100 ans plus tard, près de deux Terriens sur trois vivraient sous un ciel où la luminosité est en permanence supérieure de 10 % à celle d'une nuit de pleine lune. On estime qu'en Amérique du Nord seulement, le tiers de la lumière diffusée par les sources lumineuses artificielles est inutilement dirigé vers la voûte céleste. Il en résulte non seulement un formidable gaspillage d'argent et d'énergie, mais une diminution de la capacité d'observer les étoiles, qui alerte les astronomes stellaires de tout acabit, inquiets devant la perspective de perdre définitivement de vue une voûte étoilée, pourtant déclarée comme faisant partie du patrimoine mondial à préserver par l'UNESCO, depuis 1992.

Une lumière qui salit le ciel

Tout éclairage nocturne n'est pas pollution. Les associations militant pour un ciel noir n'en contestent aucunement l'utilité. Leur cheval de bataille ? La lumière intrusive inutilement dirigée vers le ciel, qui éblouit, s'infiltre dans les logis et voile les étoiles en créant un halo lumineux. Le phénomène est d'autant plus problématique que la lumière ne demeure pas circonscrite à l'intérieur des limites des agglomérations, grandes ou petites. La Fédération des astronomes amateurs du Québec (FAAQ) souligne même, dans son mémoire déposé dans le cadre de la consultation publique sur le développement durable, que le dôme lumineux créé par la ville de Montréal influence la qualité du ciel étoilé dans un rayon de 150 kilomètres. Les astronomes montréalais doivent donc rouler plus d'une heure et demie pour avoir le « privilège » d'observer les étoiles.

On constate que les espaces naturels sont aussi affectés par ces diffusions de lumière lorsqu'on se rend, par exemple, dans le populaire secteur de Rivière-à-la-pêche du parc national de la Mauricie. C'est qu'au cœur de cette aire de camping, où des efforts énergiques sont pourtant déployés pour la préservation de l'intégrité écologique des écosystèmes, l'expérience bien naturelle de la nuit noire est rendue difficile par la présence d'un halo lumineux attribuable à la lumière générée par le complexe urbain Grand-Mère, Shawinigan et Shawinigan-Sud, qui se trouve à une vingtaine de kilomètres du site.

Une lumière qui nuit

Si on qualifie de « pollution » cette nuisance lumineuse, c'est parce que la pollution n'affecte pas toujours directement la santé d'espèces vivantes, mais modifie leurs caractéristiques, leur comportement et leur répartition. C'est aujourd'hui le cas de certains écosystèmes.

Pollution lumineuse

Une réserve de ciel étoilé au Mont-Mégantic

Cette image de l'observatoire du Mont-Mégantic symbolise tout l'enjeu du projet de réserve de ciel étoilé : prise en septembre 2005, on y voit la coupole de l'observatoire, les volutes d'une aurore boréale à droite et la menace insidieuse du halo lumineux de la ville de Sherbrooke à gauche. Une image en passe de disparaître !

C'est un projet très ambitieux de réserve de ciel étoilé qui est actuellement mis en place par le Parc national du Mont-Mégantic au Québec. Mené par l'Astrolab (le centre de vulgarisation de l'observatoire), le Parc national du Mont-Mégantic et l'observatoire lui-même, il vise un contrôle strict de l'éclairage afin de minimiser la pollution lumineuse dans toute la région.

Bien qu'éloignée des centres urbains, la région est tout de même menacée par une pollution lumineuse toujours plus présente. "En gros, les temps d'observation doivent être augmentés de 20 à 40 %", explique Pierre Bastien, le directeur de l'observatoire. Certains travaux de recherche ont même récemment été abandonnés, car il est devenu impossible de les faire en un temps raisonnable. C'est l'étude des galaxies qui est la plus affectée. Un sujet de recherche dont j'étais justement chargé en 1993, lorsque j'ai décidé d'agir. Les longues poses me permettaient de flâner sur la passerelle pour admirer le firmament... et la pollution lumineuse.

Un projet régional

À l'époque, je revenais d'Hawaii où le ciel est très noir. Choqué par la situation ici, j'ai proposé que l'on instaure une réserve de ciel étoilé. En 2000, quelques heures avant de parle pour l'Espagne où m'attendait un stage postdoctoral, j'ai déposé auprès d'une commission sur le patrimoine un mémoire traitant en détail du problème. Ce dernier est resté lettre morte jusqu'en 2003, date à laquelle l'Astrolab a engagé l'ingénieure Chloé Legris afin de le mettre en œuvre. Il s'agit d'un projet majeur. En effet, la réserve couvre les 30 villes et villages des municipalités régionales des comtés du Granit et du Haut-Saint-François, couvrant un rayon de 50 km autour de l'observatoire. La ville de Sherbrooke en fait également partie. Une région d'intervention aussi vaste s'avère nécessaire afin de protéger efficacement l'observatoire du Mont-Mégantic.

APPENDIX B : EASTERN TOWNSHIP LANDSCAPE CHART

Charte des paysages estriens

La Charte des paysages estriens se veut un outil de sensibilisation à la protection et à la mise en valeur de nos paysages. Elle repose sur un ensemble de valeurs, de principes et d'engagements que partagent élus, municipalités, ministères, entreprises privées, organismes et citoyens dont les actions ont un impact sur le paysage. Cette charte a pour but d'assurer que le paysage soit pris en considération lors de toute intervention dans le milieu.

Le paysage désigne une partie de territoire telle qu'elle est perçue par les populations, dont le caractère résulte de l'action de facteurs naturels ou humains et de leurs interrelations.

Ses objectifs

À titre d'outil de valorisation des paysages, la Charte a pour objet de:

- promouvoir la protection du patrimoine paysager;
- sensibiliser les intervenants à la valeur des paysages et à l'impact des interventions en matière d'aménagement du territoire;
- favoriser la concertation en ce domaine.

Ses valeurs et ses principes

Les signataires reconnaissent les valeurs et les principes suivants:

Article 1 le patrimoine bâti et naturel est le fondement du paysage;

Article 2 le paysage est un élément distinctif du cadre de vie de la collectivité, notamment sur les plans culturel, économique, esthétique, environnemental et social;

Article 3 la diversité et la qualité du paysage constituent une ressource et un moteur économique déterminants;

Article 4 la qualité du cadre de vie et la beauté des paysages constituent un facteur d'attraction, tant pour les nouveaux résidants et les visiteurs que pour les entreprises;

Article 5 la protection, la gestion et la mise en valeur du paysage, en tant que bien commun, sont d'intérêt aussi bien public que privé, ainsi que de responsabilité autant individuelle que collective;

Article 6 les techniques de productions agricole, forestière, industrielle et minière, ainsi que les pratiques en matière d'aménagement du territoire, d'urbanisme, de transport, de tourisme et de loisirs transforment les paysages et ont des conséquences sur eux;

Article 7 les citoyens ont droit à un cadre de vie équilibré, favorable à la santé et culturellement significatif;

Article 8 les citoyens ont le droit d'accéder aux informations relatives au patrimoine paysager détenues par les autorités publiques et de participer à l'élaboration des décisions ayant une incidence sur le paysage qu'ils contribuent, par leurs activités, à façonner;

Article 9 le ciel étoilé est reconnu comme un bien et un patrimoine scientifique, environnemental et paysager; il doit à ce titre être protégé de la pollution lumineuse.

Starry night is recognised as a scientific, environnemental and landscape heritage who must be protected.

Ses engagements

Les signataires s'assurent de la mise en œuvre des engagements suivants:

Article 1 prendre des mesures adéquates visant à sauvegarder, à protéger et à mettre en valeur le patrimoine paysager et faire en sorte qu'il soit une préoccupation constante lors de toute intervention sur le territoire;

Article 2 concilier le développement économique avec la protection des paysages tout en assurant la cohérence des décisions, des actions et des interventions;

Article 3 promouvoir le paysage comme valeur dans toute politique de développement durable, notamment dans les secteurs culturel, touristique, agricole, forestier, commercial, urbain et industriel;

Article 4 inscrire la valorisation du paysage parmi les outils de planification et de gestion du territoire (schéma d'aménagement, plan et réglementation d'urbanisme, plan d'implantation et d'intégration architecturale, plan d'aménagement d'ensemble ou autres);

Article 5 accroître les efforts de sensibilisation à la valeur des paysages auprès de la collectivité, des organismes privés et des autorités publiques de la région, notamment auprès des jeunes et dans les programmes d'éducation;

Article 6 soutenir l'acquisition et la diffusion de connaissances favorisant la protection et la valorisation du patrimoine paysager, ainsi que la recherche et l'innovation dans le domaine;

Article 7 porter attention aux interventions pouvant nuire aux paysages;

Article 8 promouvoir une planification concertée inscrivant, dès ses débuts, un processus participatif dans la prise de décisions et dans la mise en œuvre de projets touchant le paysage;

Article 9 considérer la protection du ciel étoilé dans la gestion de l'éclairage extérieur.

Consider starry night protection in outdoor lighting management

Signature

Organisme

Date

Paysages estriens
Comité du patrimoine paysager estrien

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APPENDIX C: MUNICIPAL COUNCIL RESOLUTIONS ABOUT ADOPTION OF THE REGULATION

PROCÈS-VERBAL OU COPIE DE RÉSOLUTION

MUNICIPALITÉ RÉGIONALE DE COMTE DU GRANIT

Mercredi le 23 mars 2005, se tient à 19 h 30, à l'hôtel de ville de Frontenac la deuxième séance de la session du conseil de la Municipalité Régionale de Comté du Granit. Madame la préfet et les maires ci-dessous énumérés participent à la rencontre.

André Grenier	Fernand Coulombe	Jean-Denis Cloutier
Jean-Guy Gagnon	Colette Roy Laroche	Marc Turcotte
Jacques Lalonde	Claude Turcotte	Ginette Dupuis
Jean-Denis Turgeon	André Mercier	Réal Chouinard
Maurice Guay	Félix Destrijker	Jeanot Lachance
Jean-Luc Fillion	Marcel Proteau	Noël Grondin
Luc Glaude		

Madame la préfet, Francine Blais, préside la séance. À titre de secrétaire-trésorier de la M.R.C., j'agis comme secrétaire.

2005-78

ADOPTION D'UN RÈGLEMENT DE CONTRÔLE INTÉRIMAIRE (RCI)

Il est proposé, appuyé et résolu :

QUE le règlement n° 2005-08, «RÈGLEMENT MODIFIANT LE RÈGLEMENT DE CONTRÔLE INTÉRIMAIRE NO 94-06 CONCERNANT LES DISPOSITIONS RELATIVES AU CONTRÔLE DE L'ÉCLAIRAGE EXTÉRIEUR (POLUTION LUMINEUSE)», soit adopté tel que lu et ici retranscrit.

ADOPTÉE À L'UNANIMITÉ

It is proposed, supported and resolveed that:

THE regulation no. 2005-08, "REGULATION MODIFYING THE INTERIM REGULATION OF CONTROL NO 94-06 CONCERNING DISPOSITION ON OUTDOOR LIGHTING CONTROL (LIGHT POLLUTION)", is to be adopted as readed and retranscrit.

UNINAMOUSLY ADOPTED

note: free translation

COPIE CONFORME CERTIFIÉE
CE 5 avril 2005
Minute: 2005-78

SERGE BILODEAU
secrétaire-trésorier et
directeur général

CANADA, PROVINCE DE QUÉBEC
MUNICIPALITÉ RÉGIONALE DE COMTÉ DU HAUT-SAINT-FRANÇOIS

RÉSOLUTION N^{O} 2006-04-3819

RÈGLEMENT DE CONTRÔLE INTÉRIMAIRE N^{O} 255-06

RÈGLEMENT DE CONTRÔLE INTÉRIMAIRE RELATIF AU CONTRÔLE DE L'ÉCLAIRAGE EXTÉRIEUR (POLLUTION LUMINEUSE)

ATTENDU QU' en vertu des pouvoirs que lui confère l'article 63 de la Loi sur l'aménagement et l'urbanisme (L.R.Q., c.A-19.1), le conseil de la Municipalité régionale de comté du Haut-Saint-François peut adopter en tout temps un règlement de contrôle intérimaire s'appliquant à chacune des municipalités qui font partie de son territoire ;

ATTENDU QUE l'ASTROLab du Mont Mégantic, en partenariat avec la MRC du Granit, la Ville de Sherbrooke et la MRC du Haut-Saint-François entendent créer une des plus importantes réserves de ciel étoilé à travers le monde tout en permettant aux municipalités de développer des ambiances nocturnes chaleureuses et sécuritaires;

ATTENDU QUE l'ASTROLab du Mont Mégantic désire assurer la protection à long terme et la pérennité des investissements en infrastructures réalisées;

ATTENDU QUE l'importance des activités de l'observation astronomique du Mont Mégantic justifie une protection adéquate;

ATTENDU QUE l'ASTROLab et la MRC du Granit ont rédigé une réglementation sur l'éclairage extérieur;

ATTENDU QU' il est pertinent d'adopter sensiblement la même réglementation afin d'assurer une uniformité;

ATTENDU QU' à cette fin, un avis de motion a été présenté le 15 février 2006, indiquant l'intention de soumettre pour adoption un règlement de contrôle intérimaire aux fins de prévoir des dispositions relatives au contrôle de l'éclairage extérieur;

EN CONSÉQUENCE, sur la proposition de Jean-Claude Dumas, appuyée par Marc-Jacques Gosselin, IL EST RÉSOLU :

QUE LE RÈGLEMENT DE CONTRÔLE INTÉRIMAIRE RELATIF AU CONTRÔLE DE L'ÉCLAIRAGE EXTÉRIEUR (POLLUTION LUMINEUSE) PORTANT LE NUMÉRO 255-06 SOIT, PAR LE PRÉSENT RÈGLEMENT, DÉCRÉTÉ ET STATUÉ COMME SUIT :

CHAPITRE 1. DISPOSITIONS DÉCLARATOIRES

Article 1.1 - Préambule

Le préambule du présent règlement en fait partie intégrante.

Note: This resolution about adopting the interim regulation of control contained all the regulation, from chapter 1 to chapter 6, which is NOT contained here. Only the first ans last page of this regulation is shown, detailed regulation is part of appendix D

CHAPITRE 6 – DISPOSITIONS PÉNALES

6.1 - Infractions et amendes

Toute contravention au présent règlement constitue une infraction et est prohibée. Quiconque contrevient à l'une des dispositions du présent règlement est passible, pour une première infraction, d'une amende minimale de 500,00$ si le contrevenant est une personne physique ou de 1000,00$ si le contrevenant est une personne morale. En cas de récidive, ces montants sont doublés.

Si une infraction dure plus d'un jour, l'infraction commise à chacune des journées constitue une infraction distincte et les pénalités édictées pour chacune des infractions peuvent être imposées pour chaque jour que dure l'infraction.

À défaut du paiement immédiat de l'amende ou de ladite amende et des frais, le contrevenant est passible de saisie de biens saisissables.

Si l'infraction continue ou ladite amende et les frais sont encourus par une corporation, association ou société reconnues par la loi, cette amende ou cette dite amende et les frais peuvent être prélevés par voies de saisie et vente de biens et effets de la corporation, association ou société, en vertu d'un bref d'exécution émis par la cour municipale.

6.2 – Recours en droit civil

Nonobstant les recours par action pénale, la Municipalité régionale de comté du Haut-Saint-François peut exercer devant les tribunaux de juridiction tous les recours de droit civil nécessaires pour faire respecter les dispositions du présent règlement lorsque le conseil le juge opportun ou peut exercer tous ces recours cumulativement.

Les poursuites intentées en vertu du présent règlement sont entendues et décidées d'après les règles contenues dans la première partie de la Loi des poursuites sommaires (LRQ, 1977, P15).

6.3 – Action pénale

Les actions pénales sont intentées pour et au nom de la Municipalité régionale de comté du Haut-Saint-François par la personne désignée à cette fin dans une résolution du conseil.

CHAPITRE 7 DISPOSITIONS FINALES

Article 7.1 – Entrée en vigueur

Le présent règlement entrera en vigueur conformément à la Loi sur l'aménagement et l'urbanisme (L.R.Q.,c.A-19.1).

ADOPTÉ LE 19 AVRIL 2006

Copie certifiée conforme au livre des délibérations,
ce 26e jour d'avril 2006.

Martin Maltais, Secrétaire-trésorier adjoint

PROVINCE DE QUÉBEC

VILLE DE SHERBROOKE

EXTRAIT DES PROCÈS - VERBAUX DU CONSEIL MUNICIPAL

Séance régulière du conseil municipal de la Ville de Sherbrooke, tenue à l'hôtel de ville, 191, rue du Palais, le 6 août 2007, présidée par le président du conseil, Bernard Tanguay, à laquelle assistaient son honneur le maire Jean Perrault, la conseillère Nicole Bergeron, les conseillers Roger Labrecque, Francis Gagnon, Louida Brochu, Douglas MacAulay, Serge Paquin, Robert Y. Pouliot, Jean-François Rouleau, la conseillère Diane Délisle, les conseillers Bernard Sévigny, Serge Forest, Julien Lachance, Jacques Testulat et la conseillère Dany Lachance.

RÉSOLUTION C.M. 2007-4233-00

Adoption d'une réglementation sur l'éclairage extérieur

CONSIDÉRANT que la région du Mont-Mégantic est sur le point d'obtenir le statut de « Réserve internationale de ciel étoilé »;

CONSIDÉRANT que l'adoption d'une réglementation sur l'éclairage extérieur à la Ville de Sherbrooke joue un rôle crucial pour la reconnaissance de la région du Mont-Mégantic;

CONSIDÉRANT que cette réglementation doit être adoptée rapidement et inscrite parmi l'ensemble des règlements d'amendement aux règlements d'urbanisme à adopter dans les prochains mois;

Il est

PROPOSÉ PAR LE CONSEILLER BROCHU
APPUYÉ PAR LE CONSEILLER ROULEAU

Qu'un règlement de contrôle intérimaire (RCI) visant à régir l'éclairage extérieur sur les propriétés publiques et privées soit adopté dans les meilleurs délais et que d'ici là, tel que fait par le passé, toutes les mesures nécessaires seront prises pour limiter l'impact des nouvelles installations sur le paysage nocturne.

That a interim regulation of control to control outdoor lighting of publics and privates propreties is to be adopted as soon as possible and that, by then,

- ADOPTÉ -

all necessarly actions are to be taken, as in the past, to limit the impact on the nighttime landscape of all new installations.

« Je, soussignée, Isabelle Sauvé, greffière de la Ville de Sherbrooke, certifie par les présentes que l'extrait ci-dessus est vrai. »

La greffière de la Ville,

Isabelle Sauvé

Me Isabelle Sauvé

APPENDIX D: TECHNICAL AND REGULATORY GUIDE

THE FOLLOWING GUIDE IS THE LAST REVIEW, IN EARLY 2006. FIRST EDITION WAS IN 2005, WHEN THE MRC OF GRANIT HAVE ADOPTED THE REGULATION.

IN THE APPENDIX A OF THE FOLLOWING "TECHNICAL AND REGULATORY GUIDE" IS THE REGULATION AS ADOPTED BY THE MRC'S. SOME MINOR DIFFERENCE MAY OCCUR FROM ONE MRC TO THE OTHER, BUT THE MAJOR ONE IS FOR SHERBROOKE WHERE ALL RESIDENTIAL PROPRETIES ARE NOT YET TOUCHED BY THE STANDARDS.

THE GUIDE SHOWS ALSO THE DIFFERENCES IN THE STANDARDS WHETER THE MUNICIPALITY IS CLOSE OR FAR FROM THE CORE OF THE RESERVE.

PLEASE NOTE THAT APPENDIX B AND C OF THE FOLLOWING GUIDE HAVE BEEN TAKEN AWAY IN ORDER TO LIMIT THE SIZE OF THIS NOMINATION PACKAGE.

ASTROLab
DU MONT-MÉGANTIC

Technical and regulatory guide
for outdoor lighting - 2006

Light pollution abatement projet

Acknowledgments

We would like to thank the following for their moral and/or technical support

The members of the ASTROLab Board of Directors
Pierre Goulet, Director of Mont-Mégantic National Park
Rémi Lacasse, President of the Fédération des astronomes amateurs du Québec

Martin Aubé, Ph.D., Collège de Sherbrooke, Physics Research and Application Group
Chrisnell Blot, Eng., President of Spectralux, Lighting and Testing Laboratory
Denis Bourret, Agence de l'efficacité énergétique, Province of Quebec
Michel Caron, Eng., Maintenance and Building Director, City of Sherbrooke
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OMM

SADC
Société d'aide au développement de la collectivité de la région de Mégantic

Emploi Québec

Natural Resources Canada

Ressources naturelles Canada

[χ] graphycs

2006 revision
Document prepared by
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1. INTRODUCTION

As part of the light pollution abatement project, the action plan is being implemented in three components, which are awareness, regulations and lighting fixture conversion, in order to create one of the largest reserves of dark sky in the world and to ensure the sustainability of astronomy research in Quebec and Canada. This project has always been managed so as to reconcile a maximum number of objectives, thereby creating strong regional – and even national – cohesion. Light pollution abatement is a sustainable development project. The two main elements that influenced the development of this technical and regulatory guide were saving the night sky and increasing energy efficiency.

This technical and regulatory guide is intended for a wide range of stakeholders (municipalities, electricians, engineers, urban planners, inspectors, architects, lighting product distributors, etc.) to help them develop their lighting knowledge and understanding of the standards that are being proposed in the municipalities of the Granit and Haut-Saint-François regional counties, and in the City of Sherbrooke.

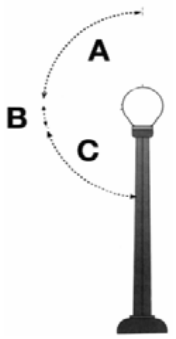
This guide starts by providing some background information by describing the problems created by light pollution, which include sky glow, light trespass, glare and wasted energy. Each section then discusses the elements covered by the regulations (light sources, luminaires, illumination level and operating hours) and concludes with a table that summarizes the proposed standard for this aspect. Detailed regulations are contained in Appendix A of the document, covering the MRC du Granit draft regulations. Appendices B and C contain examples of standard photometric reports for luminaires and a typical application situation.

We hope that this guide will contribute significantly to saving the dark sky in the Mont-Mégantic region, and that it will also serve as a reference tool that will contribute to the development of responsible management of outdoor lighting across Quebec and Canada.

2. LIGHT POLLUTION: DEFINITIONS AND CONSEQUENCES

Lighting that is poorly designed, poorly directed or improperly used is responsible for **sky glow**, creates **glare** and generates **light trespass**. This poor use of night lighting is defined as light pollution. Streets, parking lots, parks, public buildings, businesses, industries and private residences are often lit throughout the night. By illuminating the sky this way, all these sources of light hinder star observation and celestial research, disturb nature lovers, harm the balance of ecosystems and translate into a large **loss of energy**.

In North America, it is estimated that the light energy lost to the sky equals about $1 billion annually. In addition, this excess use of energy contributes to increasing greenhouse gas emissions. Although hydroelectric energy use in Quebec does not generate greenhouse gases, many provinces and countries use coal-fired or gas-fired power plants to produce electricity, which emit greenhouse gases into the air. Promoting energy efficiency is beneficial to the environment because it helps to slow the construction of new electric power plants in Quebec and elsewhere.



Useful light from a luminaire

Zone A – Sky glow: Light emitted above the horizontal is a total loss. It blocks star observation and wastes energy.

Zone B – Glare and light trespass: Light emitted less than 10° below the horizontal causes glare and risks generating more light trespass on neighbouring properties.

Zone C – Useful light.

Source: FAAQ, Dark Sky Committee

2.1 Sky glow

When light is emitted into the sky, it encounters particles in the air and is reflected back to Earth, thereby increasing the brilliance of the night sky. The more the sky background is lit up, the less the stars are visible. For astronomers, the darkness of the sky is essential for studying celestial objects with faint light intensity.

Sky free of light pollution

Sky masked by light pollution

Sky glow is caused by light emitted directly above the horizontal, by light reflected off the ground and by white light.[1]

Source: International Dark Sky Association

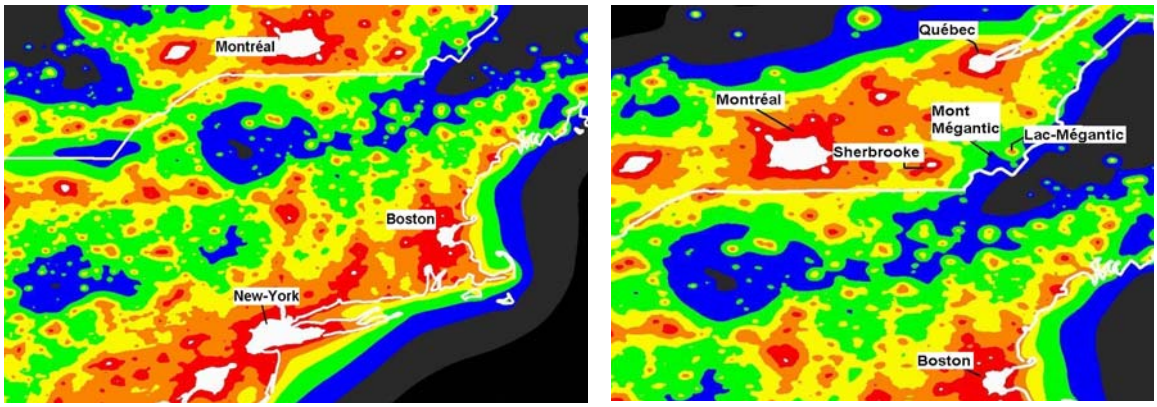
[1] See section on light sources.

In 1997, at the request of astronomers, specific observations designed for the study of light pollution were carried out (Cinzano, Falchi & Elvidge 2001; Isobe, Hamamra & Elvidge 2001) by the US Air Force Defense Meteorological Satellite Program (DMSP), resulting in the first World Atlas of Artificial Sky Brightness. These satellite images made it possible to analyze the quality of the sky compared with the amount of light emitted from the Earth. Below is the situation for eastern North America.

Bortle's scale makes it possible to rate the night sky according to the light emitted from the Earth.

Color	Description
	Natural night sky
	The Milky Way is visible
	Faint light along the horizon over distant cities
	Impact on sky observation
	Major impact on sky observation and the work of astronomers
	The Milky Way is not visible
	Less than 100 stars visible to the naked eye, much greater dome of light over cities
	Less than 20 stars visible to the naked eye, the sky is yellow or green

Satellite images of light pollution in eastern North America



Dome of light produced by Sherbrooke as seen from the summit of Mont Mégantic (75 km)

2.2 Glare and visibility

Glare can be blinding and can limit our ability to discern obstacles, or it can simply be visually uncomfortable. In both cases, glare is created by poor use of lighting and increases the risk of accidents. The photo on the right clearly illustrates that powerful, poorly directed lighting that is not uniform is blinding and hinders visibility: the pedestrian can barely be seen!

Glare or poor visibility are caused by a set of factors such as:

- Light emitted at less than 10° below the horizontal;[2]
- Too much illuminance;
- Excessive power from the light source;
- Poor lighting uniformity;
- Inadequate luminaire installation.

What About Safety?

Darkness is often associated with fear, threats or danger. Yet the majority of thefts take place during daytime. Furthermore, overly bright lighting is not safe because it blinds and reduces the depth of the field of vision, thereby making it difficult to discern night strollers. In the United States, the Dark Campus Program (adopted by a few schools in Texas, Oregon and California) has banned all lighting outside activity hours, and vandalism has dropped and even stopped in some institutions. As for road safety, there is no correlation between the number of traffic accidents and the level of lighting.

Night lighting thus creates a false sense of security and provokes excessive use of light. Moreover, besides the alleged reasons, overconsumption of light can also be explained by the low cost of energy, an absence of clearly defined practices, marketing strategies and a poor understanding of the phenomenon of light pollution.

2.3 Light trespass

Light trespass is the light that shines into our homes – the light that falls beyond property limits.

Light trespass deprives us of peace inside our homes, on our property and in our gardens, in addition to limiting our access to the beauty of a star-filled sky. No valid excuse justifies lighting neighbouring properties. This is excessive use of light and, therefore, of energy.

Furthermore, recent studies have shown how important it is for **human health** to get a good night's sleep in the darkest possible room. Many hormones and cells in the immune system function only in total darkness, including cells that combat certain cancers.[3]

[2] See the previous section, "Useful light from a luminaire".
[3] Ecology of the Night Symposium, Circadian Rhythm and Human Health, Dr. Joan E. Roberts, Ph.D.

2.4 Lost energy

From the satellite images of light pollution in section 2.1, it is also possible to estimate the amount of energy used to light the sky. These studies show that Quebec is one of the most illuminated areas in the world. By applying some basic principles – efficient lamps and luminaires, adequate lighting levels and controlled operating hours – it is estimated that the potential energy savings would amount to **several hundreds of GWh annually in Quebec**, or the equivalent of several dozen million dollars annually.

A flagrant case of the misuse of light energy is the **extremely common** use of security lighting that emits a large percentage of light and energy upward, and that is often used with mercury vapour light sources and remains on all night. We do not know how many security lighting fixtures in Quebec use mercury vapour lamps, but they are very common in residential neighbourhoods in rural and semi-rural areas, and in industrial and commercial areas.

Annual cost of typical dusk to dawn security lighting

Mercury vapour lighting ± $100

Motion detector ± $10

In 2003, in Quebec alone, 3,700 security lighting fixtures were sold, including 2,200 that were 400-watt mercury vapour lamps. A 400-watt mercury vapour lamp can be replaced by a 100-watt high-pressure sodium lamp that generates the same amount of light. Simply banning the use of mercury vapour lamps and replacing them with high-pressure sodium lamps would result in **savings of 60%**. In addition, since security lighting fixtures direct about 20% of their light upward, action should be taken not only on the type of source, but also to work with more efficient luminaires to reach maximum energy efficiency and minimum light pollution. Many architectural street luminaires still in use in Quebec direct almost as much light upward as they do downward. In the last 10 years, technologies have improved and these types of luminaires can now reach an efficiency of 60% downward and generate minimum loss upward (from 0 to 3%).

Thus, 150-watt luminaires in Lac-Mégantic could be replaced by more efficient 70-watt luminaires, representing a savings of 50% in addition to limiting light trespass as illustrated in the adjacent photo.

Many industries, businesses and residents light the sky, street and neighbouring properties by using luminaires that do not provide adequate control of the light.

It is sometimes possible to combine energy efficiency and reduced light pollution by changing only the luminaires, but reaching these objectives is meaningful only if it is linked to managing real needs. Using the right amount of light at the right place and right time of night is mandatory for ensuring efficient management of lighting needs. Calgary, which is overlit and has a level similar to that of Montreal,[4] expects to benefit from savings of $2 million annually, or 20 million kWh/year, thanks to its public lighting conversion program.

[4] Cinzano, Falchi & Elvidge 2001; Isobe, Hamamra & Elvidge 2001.

The more we light, the more we create a need, thus provoking overlighting.

Other examples also illustrate lighting abuse. Parking lots, retail areas and many roads are illuminated an average of two to five times more than current standards recommend. For commercial reasons, businesses set their own standards. Believing that they are improving security, or simply due to a lack of information, electricians and engineers plan for more lighting than necessary.

The three photos below also illustrate this observation. This road, which is located in a rural environment, has about three times as much lighting as what is recommended for this type of traffic area. The section that is not lit thus seems very dark in contrast and if obstacles, pedestrians or animals are on the road outside the illuminated area, they cannot be seen. The pedestrian appears as he steps into the lit area, but otherwise he would not have been seen until the last minute! Much dimmer lighting providing a better transition between the lit and unlit areas would improve visibility.


Photo: Guillaume Poulin

Furthermore, considering that many installations do not require lighting to be on all night, the savings would be even greater. A drive along Highway 20 between Quebec City and Montreal alone shows the impressive number of lighting fixtures that are on to light up deserted areas.

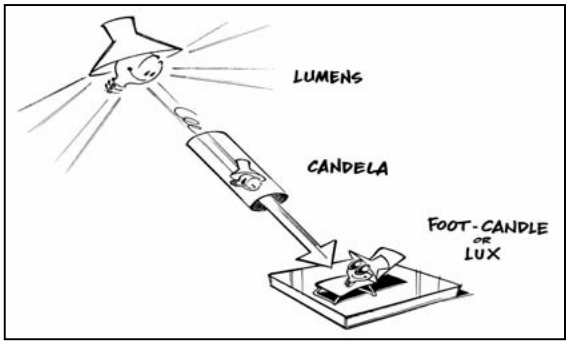
Controlling hours of operation could be a very effective solution for reducing energy consumption while minimizing excess lighting during a large part of the night.

3. UNITS OF MEASURE

Luminous flux – lumen (lm)

Total amount of light emitted in all directions by a light source. Luminous flux is measured in **lumens (lm)**. One 100-watt incandescent bulb emits 1,500 lumens, while a 100-watt high-pressure sodium lamp emits 10,000 lumens.

By analogy, the flow of water from a shower head.



Source: Lumec

Luminous intensity – candela (cd)

Quantity of light emitted in a given direction, or vector quantity. Luminous intensity is measured in **candelas (cd)**. One candela is equal to the intensity of a candle. 1 cd = 1 lumen per sr
(sr: steradian – unit of a solid angle in a sphere).

By analogy, the water flowing through a hole in a shower head.

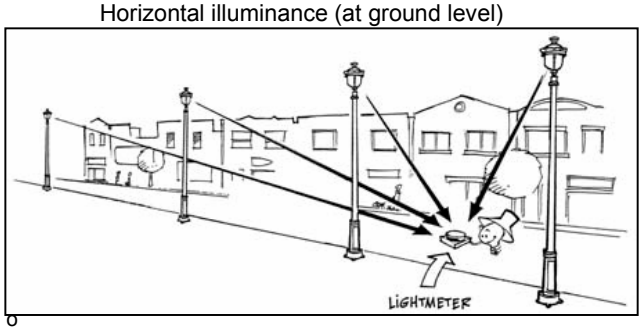
Illuminance - lux (lumens/m²)

Average quantity of light that reaches a surface. Illuminance is measured in **lux** (lumens/m²) or **foot-candles** (lumens/ft²).

1 foot-candle = 10.76 lux

Light meters are used to measure illuminance.

Horizontal illuminance (at ground level)



Source: Lumec

4. PURPOSE OF REGULATIONS

Because of the problems caused by light pollution on the research capacity and scientific effectiveness of the Mont-Mégantic Observatory, the purpose of outdoor lighting standards is to determine means to control outdoor lighting so as not to create unreasonable obstruction to celestial observation and enjoyment of the night sky. The standards are intended to encourage the use of non-polluting outdoor lighting by regulating the wavelengths emitted by light sources, the percentage of uplight, and the amount of light permitted according to the activity, while also maintaining security and productivity levels, minimizing glare and light trespass, and promoting energy efficient outdoor lighting.

To achieve this, different regulations and recommendations were studied to develop a regulatory framework that encompasses as many objectives as possible. The table below summarizes the impact of the different standards proposed according to the objectives targeted by the regulations.

TABLE 1

The impact of the proposed standard on the targeted objective is… A: very significant B: significant C: somewhat or not significant	**Proposed standards**			
	Equipment		**Quantity of light**	**Hours of operation**
Targeted objectives	Light source	Luminaire		
Sky glow	A	A	A	A
Energy savings	A	B	A	A
Light trespass	C	A	B	A
Glare	B	A	B	C

It is essential to stress the fact that the introduction and application of regulations do not result in an obligation to install lighting!

Assessing the need to light…

1. Is it necessary to provide light?
2. For which reasons?
3. How many hours per night?
4. What surface needs to be lit?
5. How much light is needed?

5. ENVIRONMENTAL ZONES

In 1997, the *International Commission on Illumination* (CIE)[5] defined four environmental zones as a working base for any new outdoor lighting regulations and the *Illuminating Engineering Society of North America* (IESNA)[6] recommends their use. The environmental zones were first established to protect natural sites such as conservation parks and observatories, but they are also used today to limit the use of night lighting and energy consumption, while improving visual comfort.

The amount of light required for any visual task often depends on the surrounding light. For some tasks, the eye does not need the same level of lighting in a dimly lit environment as it does in a downtown area. For instance, a sign in a rural area only needs a small amount of light to be seen, whereas in a downtown area, the same sign would require much more illuminance to be seen because its environment is already brightly lit. Visual perception is based on the notion of contrast.

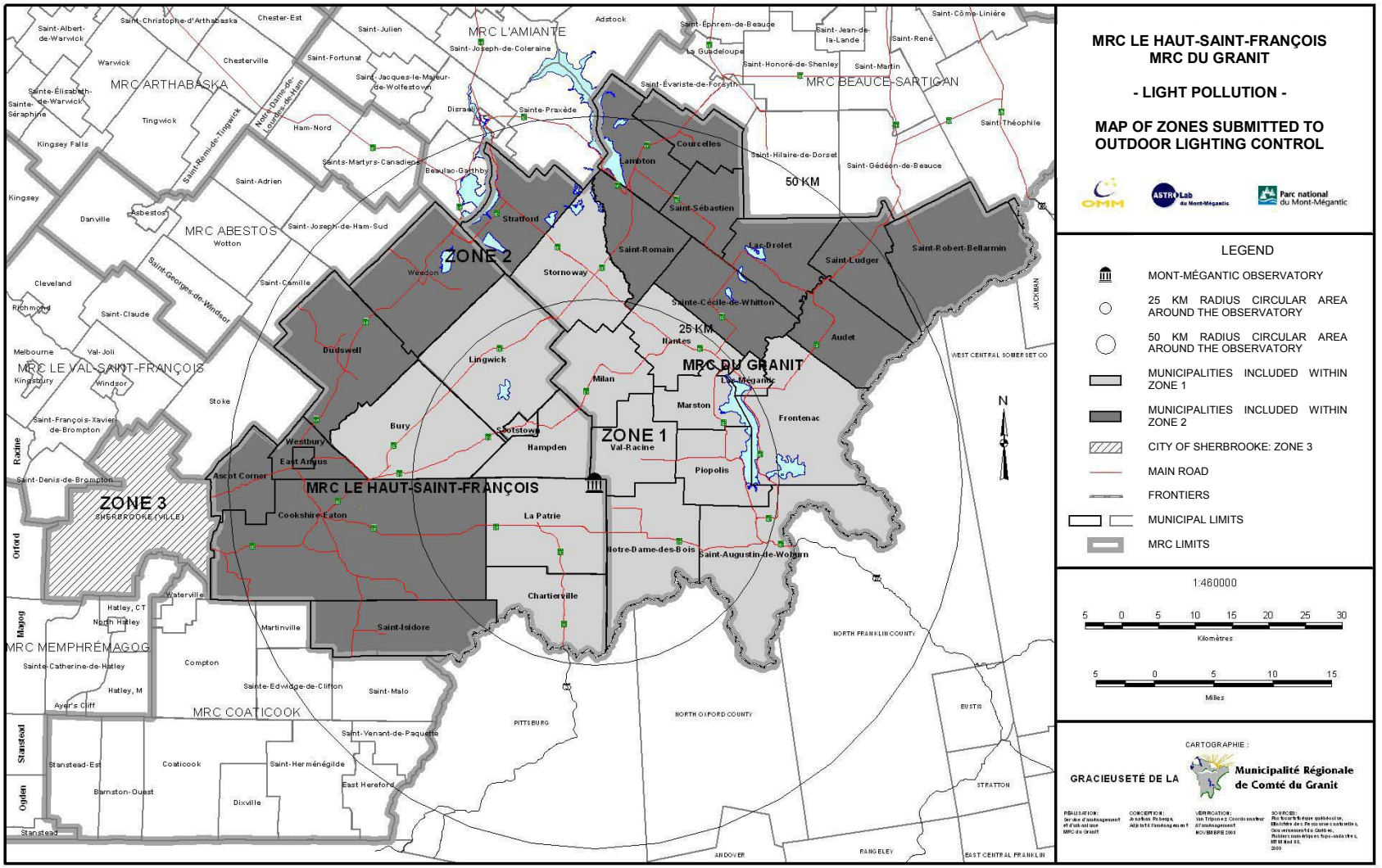
The use of environmental zones thus makes it possible to establish different standards according to the nature of the activities related to certain regions, cities or villages. Zone E1, as defined by the CIE, was established to protect astronomy sites or natural environments. The Mont-Mégantic region is affected by a specific problem. The protection areas were defined according to light pollution studies conducted in the region. Because of a 50% contribution to light pollution, the 0-25 km zone is thus considered to be an E1 environmental zone. The other surrounding municipalities, those in the 25-50 km zone around the Observatory, are classified as E2, while the city of Sherbrooke is classified as E3.

TABLE 2
ENVIRONMENTAL ZONES

		CIE Description	Municipalities
ENVIRONMENTAL ZONES	1	Intrinsically dark areas Astronomical observatory and conservation parks protection areas Residential sectors where controlling light trespass is important	0-25 km around the Observatory Mont-Mégantic National Park Bury, Chartierville, Frontenac, Hampden, Lac-Mégantic, Marston, Milan, Nantes, Notre-Dame-des-Bois, La Patrie, Scotstown, Stornoway, Val-Racine, Piopolis, Woburn
	2	Moderate brightness areas Rural areas Residential sectors far from urban centres	25-50 km around the Observatory Ascot Corner, Audet, Cookshire-Eaton, Courcelles, Dudswell, East Angus, Lac-Drolet, Lambton, Saint-Isidore, Saint-Cécile-de-Whitton, Saint-Ludger, Saint-Romain, Saint-Sébastien, Stratford, Weedon, Westbury
	3	High brightness areas Commercial sectors Urban residential sectors	Sherbrooke

[5] CIE, "Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations", Report of committee TC5.12, Obtrusive light.
[6] RP-33-99, Lighting for Exterior Environments.

MAP OF ENVIRONMENTAL ZONES AROUND THE OBSERVATORY



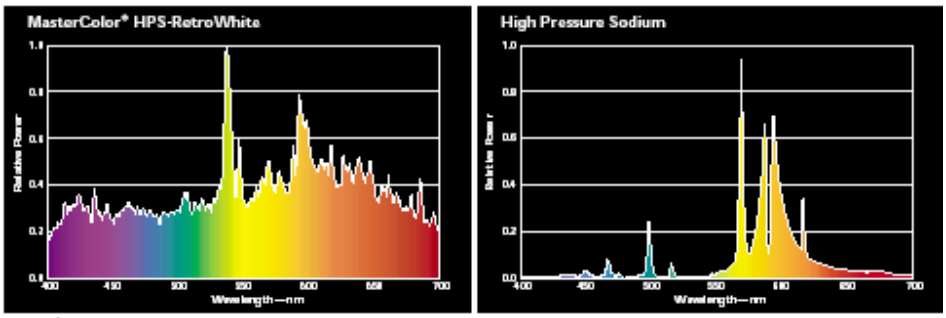
6. STANDARDS FOR REQUIRED EQUIPMENT

6.1 Light sources

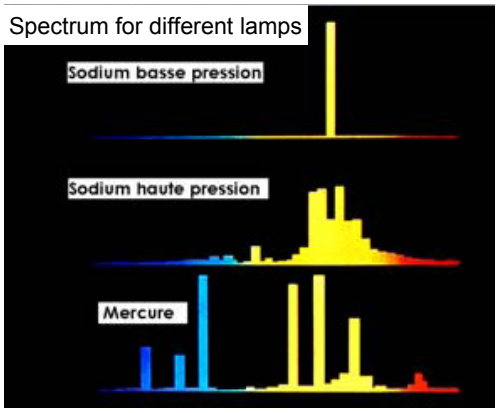
The visible spectrum of light emits wavelengths ranging from ultraviolet to infrared. The intensity of each of these wavelengths varies between light sources.

For instance, the visible spectrum for:

- Low-pressure sodium lighting is monochromatic. It emits a single wavelength in the yellow range.
- High-pressure sodium lighting emits primarily in the yellow range and very slightly in the blue and red ranges.
- Mercury, metal halide and fluorescent lighting emit all types of wavelengths.



Source: Philips



Low-pressure sodium

High-pressure sodium

Mercury vapour

Source: International Dark Sky

Why limit the use of white light sources?

White light sources
Mercury vapour, metal halide, incandescent, halogen, compact fluorescent, fluorescent, induction

Yellow light sources
Low-pressure sodium and high-pressure sodium

The most harmful light sources for observing stars (white lights) often have a higher energy cost and a greater impact on human health and the ecosystem, hence the benefit of adopting regulations to limit the use of certain ones. However, for some applications where the colour of objects is important for safety or esthetic reasons (sports fields, signs, hospital emergency areas, etc.), white lights do provide better colour rendering.[7]

Astronomy aspect
A white light emits more blue wavelengths into the atmosphere than a so-called "yellow" light. Because blue wavelengths have an impact that is two to four times greater than yellow ones on the brilliance of the sky, they are more harmful for celestial observation. In addition, it is better to have monochromatic light sources (one wavelength), such as low-pressure sodium, close to an observatory since it is easier to filter them out during observations.

Energy aspect
For a light source to appear white, it must contain all the colours in the visible spectrum. The human eye is much more sensitive to wavelengths associated with yellow than those associated with blue. Since the eye is less sensitive to blue, the light source must therefore produce a greater amount of blue to obtain the whiteness that is desired. Therefore, for the same quantity of light, several white light sources are less energy efficient than those that emit primarily yellow wavelengths. However, technologies to produce light are constantly improving and the general statement that white lights are less efficient is not always true. The arrival of compact fluorescent lamps and light emitting diodes (LED) are good examples of this.

[7] See the definition for "colour rendering index".

The following table summarizes the main comparison elements for evaluating the advantages and disadvantages of each of the commonly used light sources.

TABLE 3

Comparison criteria	**Light sources**								
	Low-pressure sodium (LPS)[8]	High-pressure sodium (HPS)[10]	Metal halide (MH)[10]	Fluorescent[10]	Induction	Mercury vapour[10]	Incandescent	Halogen	Compact fluorescent
Efficiency (Lumen/watt)	100 to 200	57 to 135	43 to 135	42 to 92	47 to 65	15 to 60	13 to 18	15 to 25	50 to 80
Lifetime (hours)	10,000 to 18,000	12,000 to 24,000	10,000 to 15,000	10,000 to 24,000	100,000	12,000 to 24,000	1,000 to 2,000	1,000 to 4,000	6,000 to 20,000
Colour rendering index (CRI)	None 0	Poor 22	Good 65 to 80	Good 70 to 90	Good 80	Average 50	Good 100	Good	Good 80
Lumen depreciation (%)	0	10	25	15	20	50	10	-	15

High-pressure sodium

Low-pressure sodium

Incandescent

Compact fluorescent

The table shows that low and high-pressure sodium light sources are more energy efficient, they have a longer lifetime and low lumen depreciation over time. The standards for zones 1, 2 and 3 are proposed in order to preserve the quality of the night sky and to promote the use of more energy efficient light sources. The standards are thus intended to encourage the use of low or high-pressure sodium sources and to tolerate white light sources only for specific applications. In addition, it would be pertinent to limit (but not ban) the lumens emitted by halogen and incandescent sources because they are not very efficient and emit undesirable wavelengths. Nevertheless, since they are very common for small applications, their use cannot be avoided.

[8] Efficiency does not include loss in the ballast.

RECOMMENDED STANDARDS FOR LIGHT SOURCES

TABLE 4

ENVIRONMENTAL ZONES		**Yellow light sources**	**White light sources**			
		High-pressure sodium, Standard low-pressure sodium, Amber diode	Metal halide, Induction, White diode, High-pressure sodium with corrected colour rendering	Fluorescent, Neon	Incandescent, Halogen (Quartz), Compact fluorescent	Mercury vapour
	1	No restriction	Accepted only for: - outdoor sales areas - signs - sports fields	Banned	Accepted if ≤ 1,000 lumens	Banned
	2	No restriction	Accepted only for: - outdoor sales areas - signs - sports fields	Accepted only for illuminated signs	Accepted if ≤ 1,500 lumens	Banned
	3	No restriction	Accepted only for: - outdoor sales areas - signs - sports fields - building fronts	Accepted only for illuminated signs and building fronts	Accepted if ≤ 2,000 lumens	Banned

6.2 Luminaires

Functional, roadway

Choosing the proper luminaire is an essential step in meeting the objectives of the regulations, which are to deal with sky glow, glare, light trespass and energy efficiency. Different types of luminaires are suitable for different applications. Primarily, there are functional or decorative luminaires for large areas (roadways, parking lots, etc.), wall packs and floodlights.

Decorative, large area

The luminaire's design, which is called the luminaire's photometry, determines its ability to direct the light produced by the light source to where it is desired.

Wall pack

The **photometric report**[9] is an analysis of the luminaire's luminous flux distribution and provides a variety of information. Among other things, a photometric report includes:

- The luminaire's efficiency (percentage of light emitted upward, downward, house side, street side);
- IESNA[10] classification on the type of light distribution pattern (Type I to V);
- IESNA cutoff classification (full cutoff, cutoff, semi-cutoff, non-cutoff).

The illustrations below show the resulting impact of two different luminaires, with two different photometries.

Source: Lumec

In this case, the luminous flux is well controlled and provides good visibility while minimizing the loss of light upward and towards houses.

Source: Lumec

The second case shows that the luminaire has very little control of the luminous flux as the light is emitted in all directions. In short, this is a situation to be avoided for energy reasons, to respect privacy and to preserve the night sky!

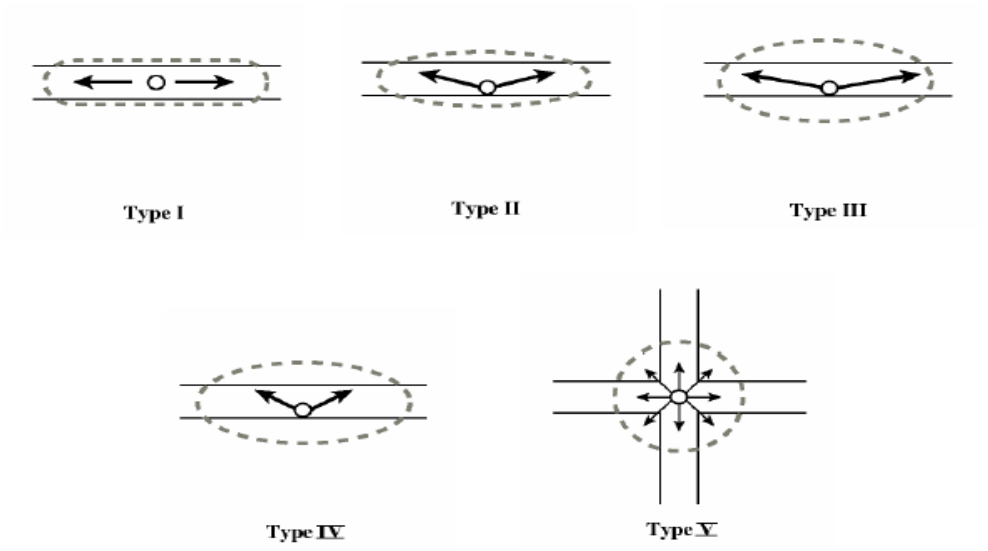
[9] See Appendix B for different standard photometric reports.
[10] Illuminating Engineering Society of North America.

What is luminaire efficiency?

Luminaire efficiency indicates the percentage of lumens emitted by the luminaire compared with the initial lumens emitted by the light source. A light source of 6,000 lumens in a luminaire with a total efficiency of 60% means that 3,600 lumens are used for lighting. However, for this efficiency, a distinction must be made between the percentage of light directed downward and the percentage directed upward. Thus, a luminaire with a total efficiency of 60% that emits 15% of the lumens upward really only uses 45% of the lumens to light downward.

Many luminaires emit a large percentage of their light directly upward or beyond the surfaces concerned, thereby lighting more than is really needed. Directing light beyond the surfaces concerned and exceeding real lighting needs results in overlighting and increases the quantity of light reflected from the ground upward. Hence the advantage of choosing a luminaire that can control the light according to real needs. The IESNA proposes a classification according to the type of downward light distribution.

IESNA classification of light distribution pattern for outdoor luminaires

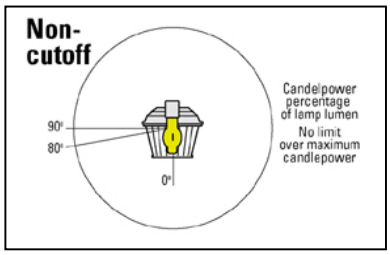


What is the IESNA cutoff classification?

The IESNA proposes a classification for luminaires according to a maximum intensity (candelas) equivalent to a percentage of the luminous flux (lumens) emitted above the horizontal and in the glare zone. Contrary to popular belief, the primary goal of this classification is not to determine the quantity of light emitted above the horizontal, but to control glare.[11] Below are the four definitions for the cutoff classifications (non-cutoff, semi-cutoff, cutoff and full cutoff), and the percentage of lumens emitted above the horizontal for each of these classifications.

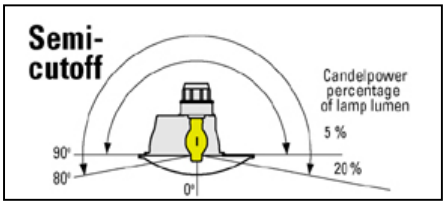
<u>Non-cutoff luminaires</u>

- No restriction on the % of luminous flux emitted above the horizontal and in the glare zone.



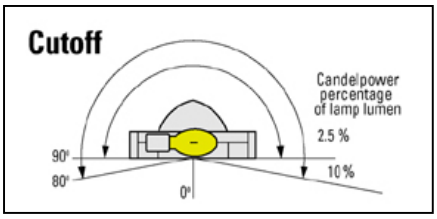
<u>Semi-cutoff luminaires</u>

- **0% to 31% of luminous flux emitted upward.**
- Intensity (candela) <5% of luminous flux (lumen) emitted above the horizontal.
- Intensity (candela) <20% of luminous flux (lumen) emitted between 0° and 10° below the horizontal.



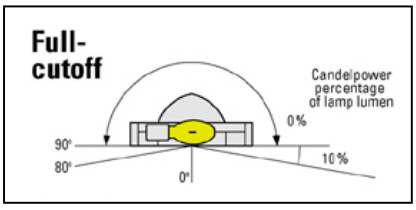
<u>Cutoff luminaires</u>

- **0% to 16% of luminous flux emitted upward.**
- Intensity (candela) <2.5% of luminous flux (lumen) emitted above horizontal.
- Intensity (candela) <10% of luminous flux (lumen) emitted between 0° and 10° below horizontal.



<u>Full cutoff luminaires</u>

- **No luminous flux emitted above the horizontal.**
- Intensity (candela) <10% of luminous flux emitted between 0° and 10° below the horizontal.



Thus, a luminaire can be classified as semi-cutoff and not emit any lumens above the horizontal. Conversely, a cutoff luminaire can emit up to 16% of its lumens above the horizontal.

[11] The percentage of lumens emitted above the horizontal is what should be considered. The data are usually provided in the photometric report, but some luminaire models do not provide this information.

Although many regulations favour the use of full cutoff luminaires only, it has nevertheless been shown that this is not always the best option for energy efficiency or the quality of lighting design. The standards proposed in the table below tolerate up to 2.5% of light being emitted above the horizontal to encourage the use of luminaires that offer both good control of luminous flux and good efficiency.

It is thus better to control the percentage of light emitted upward using the luminaire's photometric report indicating the percentage of lumens emitted above the horizontal (% upward or uplight) than the IESNA classification.

Only the full cutoff classification gives exact information regarding the percentage of light emitted above horizontal, which is 0%!

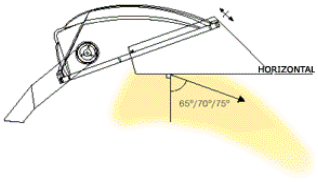
Using floodlights

Floodlights are luminaires that can be adjusted to the desired angle. These lighting fixtures are often poorly used and direct a large quantity of light directly upward or beyond the areas to be lit.

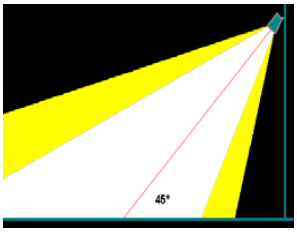
Whether floodlights are for lighting building fronts, signs, sports fields or other large areas, they should be used in such as way as to limit the needless loss of light. Consequently, the luminous flux must be projected downward either by pointing the floodlights adequately below the horizontal or by attaching internal or external shielding.

The luminous flux emitted by a floodlight can be concentrated into a beam that can vary from 10° to 100°. It is primarily for this reason that it is difficult to enforce a maximum tilt angle when the use of floodlights is required. To light large areas, manufacturers should be consulted to ensure that the floodlights comply with the standard for the percentage of light emitted above the horizontal by using the appropriate tilt.

Floodlight with shielding



Appropriate angle for floodlight



RECOMMENDED STANDARDS FOR LUMINAIRES

1.0 All luminaire installations must:

1.1 In Zone 1: emit less than 1% of luminary flux above the horizon, as certified by the photometric report, and or;
In Zones 2 and 3: emit less than 1% of luminary flux above the horizon or, if the luminaire is mounted lower than 5 m, emit less than 2.5% of luminary flux above the horizon, as certified by the photometric report, and/or;

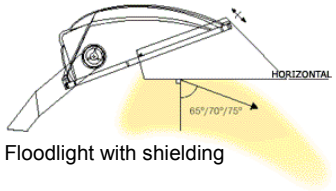
1.2 Be classified as IESNA full cutoff, and/or;

1.3 Have a flat lens, and/or;

1.4 Have shielding that entirely shields the luminary source, and/or;

1.5 Be installed directly below overhanging areas (eaves, balconies, roof projections, etc.) of a building.

2.0 Floodlights must not be tilted at an angle that is greater than 15° above the horizon or, if the tilt is greater than that angle, they must have internal and external shielding to ensure they comply with the percentage of light emitted above the horizontal.



Floodlight with shielding

7. STANDARDS FOR LIGHT QUANTITY

7.1 Horizontal illuminance

Horizontal illuminance is the quantity of light that reaches the ground. The IESNA recommends minimum illuminance levels for certain applications, but since the IESNA standards are not included in any codes or regulations, the developers or designers of new facilities can do as they please when it comes to planning lighting.

In addition, illuminance levels are not always established according to the surrounding light environment, hence the advantage of defining them according to the environmental zone, like the *California Energy Commission* (CEC) does in the development of new outdoor lighting standards entitled "Title 24 Standard." Since the primary purpose of the new California standards is energy efficiency, they are based on a wattage limit per unit of surface (watt/ft²). The preliminary study entitled "Outdoor Lighting Research" made it possible to validate the impact of the watt/ft² limits on the levels of illuminance obtained according to the different lighting applications encountered. This work also inspired the Modeling Lighting Ordinance (MLO), a major working group reporting to the *International Dark Sky Association* that includes the best lighting specialists in the United States.

According to these draft regulations, none of the lighting applications should exceed the prescribed average illuminance level. However, to simplify enforcement of the regulations, some of these applications can also be considered based on a lumen/m²limit that is equivalent to the one prescribed by the California standards. Since the primary objective of the present guide is to limit light pollution and not just improve energy efficiency, the watt/ft² limits were translated into the lumens/m² limits contained in the MRC du Granit draft regulations found in Appendix A.

Limiting the quantity of light downward makes it possible to minimize energy costs and the quantity of light reflected upward from the ground to the sky or to our homes. However, it is important to note that for some applications, such as the lighting of footpaths or streets with many pedestrians, vertical illuminance and uniformity are just as important to ensure proper visibility. Lighting designers must pay attention to these technical aspects to ensure the resulting quality of the lighting.

*The "**point-by-point**" calculation method makes it possible to approve the compliance of proposed illuminance levels before the lighting is installed.*

*Once the lighting fixtures are in operation, a field check is done using a **light meter**.*

What is a point-by-point calculation?

Point-by-point illuminance calculations evaluate the quantity of light that reaches a horizontal or vertical plane at different points on the lit surface. The calculations are completed and provided by the manufacturers, professional lighting specialists or manufacturers' agents upon request.

In addition to being a tool to verify the compliance of illuminance levels, the calculations make it possible to analyze the quality of the proposed lighting design by supplying other information such as uniformity, minimum and maximum illuminance points, etc.

Illuminance calculations must be done taking only the surface to be lit into account.

For instance, when calculating the illuminance for a footpath, the calculation surface is the path itself, and not the surrounding grassy areas. This does not mean that there can be no light beyond the path, but the levels are set taking the actual surface into account, which is the footpath in this case.

For the point-by-point method to be realistic, the **average maintained illuminance** must be considered in the calculations and not the initial illuminance. The average maintained illuminance is calculated by applying a **maintenance factor** or **light loss factor** (LLF) to the initial illuminance level that takes various significant elements into account, such as lumen depreciation, sealing of the luminaire, the dirt accumulation factor of internal and external parts, ballast quality, etc.

As a general rule, a maintenance factor of 0.72 is used for metal halide sources, and 0.8 for high-pressure sodium sources.

Field inspection

Once the work has been completed, a field inspection is necessary to check the compliance of the illuminance calculations that were approved. For this task, a **light meter** is used to measure the initial illuminance level on the ground.

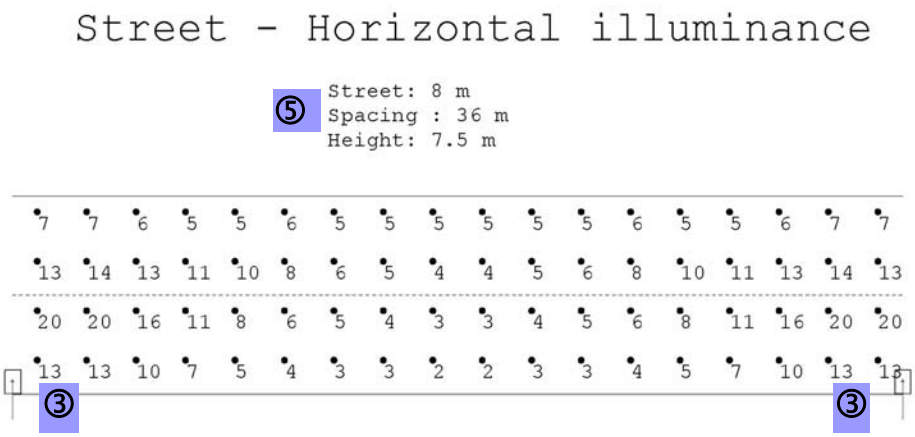
The process involves determining whether the points in the point-by-point calculation match the ones measured on the lit surface. However, the initial level measured in the field must be reduced by the established maintenance factor so that the field data can be compared with the data resulting from the maintained illuminance calculation.

Example of a point-by-point calculation

The following data should appear in a point-by-point calculation:

- Location of buildings and delimitation of lit surfaces;
- Average, minimum and maximum maintained illuminance level on the ground[12] **E_{moy}, E_{min}, E_{max}** ①;
- Uniformity of lighting (illuminance ratios) **E_{moy} / E_{min}** ②;
- Arrangement of luminaires ③;
- Length of luminaire arms, lumen, cutoff classification, light loss factor used, etc. ④;
- Spacing between luminaires, mounting height ⑤;
- Light source power ⑥.

Street Section



Luminaire Schedule ④ ⑥ 70 W HPS ④								
Project: All Projects								
Symbol	Qty	Label	Lumens	LLF	Description	Arm	IES Class	Cutoff Class
	2	L1	6400	0.800	HÉLIOS-HBS-MC3-70-SHP	1.5	Type III	Cutoff

Numeric Summary						
Project: All Projects						
Units	Avg	Max	Min	Avg/Min	Max/Min	# Pts
Lux	8.00	20	2	4.00	10.00	72

① ②

[12] When necessary, the vertical illuminance may be requested as well.

RECOMMENDED STANDARDS FOR ILLUMINANCE LEVELS

TABLE 5

Maximum values for average maintained illuminance levels for the main applications[13] concerned			
	Environmental Zones		
Applications	**1**	**2**	**3**
	Lux	**Lux**	**Lux**
Outdoor sales area			
All outdoor sales areas (garden centre, materials, etc.)	30	40	60
Display row for automobile dealerships	50	75	100
Storage area	10	10	15
Unloading, handling or work area	30	40	50
Pedestrian, cyclist area	4	6	6
Building entrance	30	40	30 to 50[19]
Street (for R_2 and R_3 reflecting surfaces)[14]			
All residential	4	6	6
Urban residential[15]	6	8	8
Village commercial[16]	8	10	12
Urban commercial	10	12	17
Industrial	6	6	9
All streets located outside of the urban perimeter should not be lighted, except for crossroads			
Outdoor parking	10	15	10 to 25[17]
Service station			
Pumping area	30	50	100
Peripheral area (or other surface under a canopy)	15	20	30
Sports area (recreational and amateur use)			
Rink, soccer, football	75	75	NA
Tennis	100	100	NA
Other sports or professional use	IESNA base standard to a maximum of 150 lux	IESNA base standard	NA

[13] Other applications are covered only with respect to lumens per m^2 of surface, such as signs or landscape/decorative lighting. See Appendix A.
[14] The data for zone 3 for Sherbrooke are for information purposes only as the levels will be defined more precisely according to the use of the street and the type of traffic on it.
[15] Considered urban residential if the ratio of dwellings per hectare is greater than 40.
[16] Any agglomeration with less than 5,000 inhabitants is defined as "village."
[17] Defined according to usage and the frequency of night visits.

7.2 Controlling light trespass

Using adequate luminaires and illuminance levels indirectly controls light trespass. However, since it is useful to have criteria to evaluate and measure light trespass, the CIE issued a standard for admissible light trespass at property boundaries. Vertical illuminance is the light that reaches a vertical surface, and light trespass is the light that would shine through an imaginary window or wall at the boundary of a property.

Using a standard specifically for controlling light trespass gives citizens the opportunity to minimize undesirable light on their property and also forces lighting specialists and developers to pay special attention to this aspect when developing design criteria. However, this standard was not used for the regulations in Appendix A since it can sometimes be complex to apply, especially when it comes to determining the origin of the source of light trespass (commercial lighting, street, neighbours, etc.). Nevertheless, it can certainly be used as a reference to evaluate a given situation and could be required for the point-by-point calculations.

TABLE 6
Recommended Standards for Light Trespass

ENVIRON-MENTAL ZONES	**Maximum illuminance in lux measured vertically at a height of 1.5 m, at the boundary of a property***	
	During operating hours	**After operating hours**
1	1	0.1
2	4	1
3	8	2

* Except light from roadway lighting

8. STANDARDS FOR OPERATING HOURS

Regardless of the application, it is better when lighting fixtures are equipped with control systems to limit their hours of operation, thereby reducing electricity consumption and the level of light pollution for a large part of the night – when astronomers are the most active! There is no reason for a lighting fixture to remain on all night when it is not useful for anyone, hence the concept of a curfew (from couvre-feu, or "cover the fire").

RECOMMENDED STANDARDS FOR OPERATING HOURS

1. *All lighting fixtures, including signs, shall be turned off at 10:00 p.m. (in zones 1 and 2) or 11:00 p.m. (in zone 3), or outside business or operating hours.*

2. *Any lighting fixtures used for security (lighting in storage areas, streets, public pedestrian areas or building entrances) are exempt from point 1.*

3. *Outdoor sales area, unloading, handling or work areas shall be illuminated at the level prescribed for storage areas outside business or operating hours, or shall reduce their lighting by 75%.*

9. DEFINITIONS

Average initial illuminance
Average illuminance level obtained over an entire surface before applying the maintenance factor. Illuminance level obtained when lighting fixtures are first put into operation.

Average maintained illuminance
Average illuminance level obtained when the maintenance factor is applied in the point-by-point calculation to evaluate the decrease in illuminance over time. Maintained illuminance thus provides a better approximation of the actual level that will be obtained a certain time after lighting fixtures are put into operation.

Colour rendering index (CRI)
An index that makes it possible to evaluate a light source's ability to correctly render the colour of objects/surfaces it is lighting. A CRI of "0" means that the source is monochromatic (one wavelength) and that it does not render colour well: all the objects will have the same hue as the source. A CRI approaching "100" means that all the colours are rendered well: blue appears blue, yellow appears yellow, etc.

Floodlight
A luminaire that can be aimed at a desired angle.

Horizontal illuminance
Average quantity of light that reaches a horizontal surface, generally the ground.

Lumen depreciation
The luminous flux (lumens) of a light source decreases over time. This value is generally provided by manufacturers at the mid-point in a lamp's lifetime.

Luminaire
A lighting unit that includes a light source, with or without ballast, integrated into the various parts used to distribute the light, direct it and protect the light source, as well as provide the required electric power.

Light meter
A device used to measure the illuminance level at a point, in lux or foot-candles, on a plane surface.

Light source (i.e. lamp)
Source of artificial light, protected by a bulb that can be of various shapes, and powered by an electric current.

Maintenance factor
The factor applied to a luminaire in illuminance calculations to evaluate the maintained illuminance. The maintenance factor takes various elements into account that have an impact on the quantity of light emitted: lumen depreciation over time, dustiness of the luminaire (depending on the luminaire's seal), ballast losses, etc.

Maximum illuminance
Maximum illuminance level at a point on a lit surface.

Minimum illuminance
Minimum illuminance level at a point on a lit surface.

Point-by-point illuminance calculation
Calculation method for determining the quantity of light, in lux or foot-candles, that reaches a horizontal or vertical plane at different points on the lit surface. The calculations are done by manufacturers, engineers or technicians specializing in lighting or manufacturers' agents, and are supplied on request.

Photometric report
A report issued by an independent photometric laboratory describing the luminous flux distribution (efficiency, percentage of lumens emitted upward, distribution of candelas in the horizontal and vertical planes) and other characteristics of the luminaire.

Shield
Screen affixed to the external or internal parts of a luminaire to limit the undesired loss of light.

Shielding
Top part of a luminaire designed to limit the emission of direct uplight. The shielding must be larger than the diameter of the light source it is covering and must partly cover it up..

Vertical illuminance
Average quantity of light that reaches a vertical surface, such as the light that reaches a wall or a pedestrian.

10. REFERENCES

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APPENDIX A

Draft Regulations

Municipalité Régionale
de Comté du Granit

LIGHT POLLUTION ABATEMENT PROJECT FOR THE MONT-MÉGANTIC REGION

Outdoor Lighting Draft Regulations

PROVISIONS FOR THE CONTROL OF OUTDOOR LIGHTING (LIGHT POLLUTION)

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PROVISIONS FOR THE CONTROL OF OUTDOOR LIGHTING (LIGHT POLLUTION)

1. Units of measure and definitions

1.1. Units of measure

Illuminance – lux (lumens/m²): Average quantity of light that reaches a surface. Illuminance is measured in **lux** (lumens/m²) or **foot-candles** (lumens/ft²). 1 foot-candle = 10.76 lux.

Luminous flux – Lumen (lm): Total amount of light emitted in all directions by a light source. Luminous flux is measured in **lumens (lm)**. One 100-watt incandescent bulb emits 1,500 lumens. *By analogy, the flow of water from a shower head.*

1.2. Definitions

Building entrance: The largest surface between either:
- 2.5 m in front of the doors and 1 m on either side of the doors; or
- the surface under the canopy.

Commercial display area: Outdoor surface where merchandise (automobiles, various materials, garden centre, etc.) intended for immediate sale is displayed for viewing by customers.

Floodlight: A luminaire that can be aimed at a desired angle.

Horizontal illuminance: Average quantity of light that reaches a horizontal surface, generally the ground.

> Average initial illuminance: Average illuminance level obtained over a surface before applying the maintenance factor. Illuminance level obtained when lighting fixtures are first put into operation.
>
> Average maintained luminance: Average illuminance level obtained on a surface and over time. Illuminance level obtained when the maintenance factor is applied in the point-by-point calculation to anticipate the decrease in illuminance over time. Maintained illuminance thus provides a better approximation of the actual level obtained a certain time after lighting fixtures are put into operation.

Illuminated sign: Sign designed to emit an artificial light through a translucent surface using a light source placed inside the sign and having one or more translucent walls.

Light source (i.e. lamp): Source of artificial light, protected by a bulb that can be of various shapes, and powered by an electric current.

Loading/unloading, handling or work area: Outdoor surface where manual tasks are performed regularly or where a large number of loading/unloading vehicles are constantly in operation. It includes, but is not limited to, access to garage doors, delivery areas, loading platforms, stacked storage of goods, and storage of hazardous materials.

Lumen depreciation: Luminous flux (lumens) reduction factor of a light source at the mid-point in a lamp's lifetime.

Luminaire: A lighting unit that includes a light source, with or without a voltage regulator (ballast), integrated into the various parts used to distribute the light, direct it and protect the light source, as well as provide the required electric power.

Maintenance factor: Factor applied to a luminaire in illuminance calculations to evaluate the maintained illuminance. The maintenance factor takes various elements into account that have an impact on the quantity of light emitted: lumen depreciation over time, dustiness of the luminaire, ballast losses, etc.

Pedestrian area: Sidewalks, public places, rest areas, staircases, ramps, footpaths, bicycle paths.

Photometric report: A report issued by an independent photometric laboratory describing the luminous flux distribution (efficiency, percentage of lumens emitted upward, distribution of candelas in the horizontal and vertical planes) and other characteristics of the luminaire.

Point-by-point illuminance calculation: Calculation method for determining the quantity of light, in lux or foot-candles, that reaches a horizontal or vertical plane at different points on the lit surface. The calculations are done by manufacturers, engineers or technicians specializing in lighting, or manufacturers' agents, and are supplied on request.

Reflection-illuminated sign: Sign that is entirely illuminated by a light source located outside the sign.

R1, R2, R3, R4 reflective surface: Property related to the ability of a surface to reflect light. R2 and R3 surfaces are normally used for roadway lighting calculations.

R1: Diffuse reflection: rough surface, concrete or cement surface.
R2: Diffuse and specular reflection: moderately smooth asphalt.
R3: Slightly specular reflection: typical highway asphalt.
R4: Specular reflection: asphalt with a very smooth surface.

Service station pumping area: Surface under the canopy, or if there is no canopy, a surface of 50 m² on either side of the gas pumps.

Shielding: Top part of a luminaire designed to limit the emission of direct uplight. The shielding must be larger than the diameter of the light source it is covering and must partly cover it up.

Storage area: Outdoor surface where various goods are stored, or manual tasks are occasionally performed, and/or where loading/unloading vehicles operate on occasion. Lighting in a storage area ensures the security of goods and equipment, while allowing pedestrians and vehicles to circulate freely. It includes, but is not limited to, handling decks, storage for goods not intended for immediate sale, peripheral lanes around the loading/unloading, and handling or work areas.

Shield: Screen affixed to the external or internal parts of a luminaire to limit the undesired loss of light.

2. Purpose of regulations

Because of the problems caused by light pollution on the research capacity and scientific effectiveness of the Mont-Mégantic Observatory, the purpose of outdoor lighting standards is to determine means to control outdoor lighting so as not to create unreasonable obstruction to celestial observation and enjoyment of the night sky. The standards are intended to encourage the use of non-polluting outdoor lighting by regulating the wavelengths emitted by light sources, the percentage of uplight, and the amount of light permitted according to the activity, while also maintaining security and productivity levels, minimizing glare and light trespass, and promoting energy efficient outdoor lighting.

Application of the standards is determined according to the proximity of lighting installations to the Mont-Mégantic Observatory. Three environmental zones are subject to the standards concerning outdoor lighting in order to create a night sky reserve in the Mont-Mégantic area.

3. Area of application

To apply these provisions, the environmental zones for the MRC du Haut-Saint-François area are made up of the following municipal areas:

Environmental zone 1:	Bury, Chartierville, Eaton, Hampden, La Patrie, Lingwick, Scotstown.
Environmental zone 2:	Ascot Corner, Cookshire, Dudswell, East Angus, Saint-Isidor, Weedon, Westbury.

4. Required lighting equipment

4.1. Light sources

All light sources used for outdoor lighting must meet the standards in Table 2.

TABLE 2: Accepted light sources based on the visible spectrum emitted

		YELLOW LIGHT SOURCES or emitting primarily yellow, orange or red wavelengths	WHITE LIGHT SOURCES or emitting a significant percentage of blue/green wavelengths					OTHERS
		Standard high-pressure sodium (1), Low-pressure sodium, Amber, red or orange diodes	Metal halide, Induction, Diodes, High-pressure sodium with corrected colour rendering	Fluorescent	Neon	Incandescent, Halogen (Quartz), Compact fluorescent, white diodes (2)	Mercury vapour	Laser, Searchlight
ENVIRONMENTAL ZONE	1	No restriction	Accepted only for: - commercial display areas; - signs; - sports fields.	Banned	Accepted only for sign lettering	Accepted if ≤ 1,000 lumens (3) Equivalence: Inc. /Hal.: 60 watts Compact fluo.: 9 watts	Banned	Use of a laser light ray or any similar light for advertising or entertainment is banned when projected horizontally. Searchlight operation for advertising purposes is banned.
	2	No restriction	Accepted only for: - commercial display areas; - signs; - sports fields.	Accepted only for illuminated signs	Accepted only for illuminated signs	Accepted if ≤ 1,500 lumens (3) Equivalence: Inc. /Hal.: 100 watts Compact fluo.: 13 watts	Banned	Use of a laser light ray or any similar light for advertising or entertainment is banned when projected horizontally. Searchlight operation for advertising purposes is banned from 10:00 p.m. to sunrise.

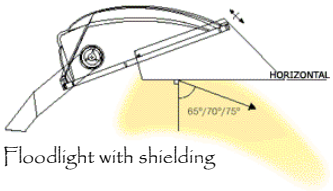
(1) High-pressure sodium with corrected colour rendering (tending to white) is not permitted because of the percentage of wavelengths emitted in the blue/green range.
(2) For small power, white diodes are acceptable.
(3) Lumen restriction does not apply to reflection-illuminated signs.

4.2. Luminaires

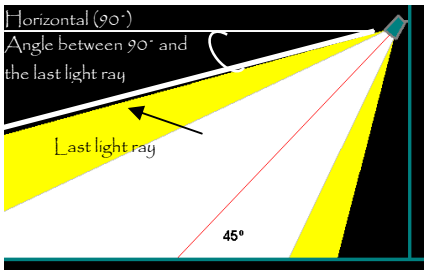
All luminaire installations must:

- in Zone 1: emit less than 1% of luminary flux above the horizon;
- in Zone 2: emit less than 1% of luminary flux above the horizon or, if the luminaire is mounted lower than 5 m, emit less than 2.5% of luminary flux above the horizon, as certified by the photometric report, and/or;
- be classified as IESNA full cutoff, and/or;
- have a flat lens, and/or;
- have shielding that entirely shields the luminary source, and/or;
- be installed directly below overhanging areas (eaves, balconies, roof projections) of a building.

Floodlights must not be tilted at an angle that is greater than 15° above the horizon or, if the tilt is greater than that angle, they must have internal and external shielding to ensure they comply with the percentage of light emitted above the horizontal.



Floodlight with shielding



5. Quantity of light permitted

5.1. Residential use

Any lighting installation designed for residential use must not exceed 15,000 lumens to light the property.

			Wattage										
			10	**15**	**20**	**25**	**35**	**50**	**60**	**70**	**75**	**100**	**150**
Lumens	Small sources	Incandescent	50	100	100	200	-	500	800	-	1000	1500	2000
		Halogen	150	-	300	-	-	800	1000	-	1000	1500	2500
		Compact fluo	600	900	1200	1800	-	4300	-	-	-	-	-
	Large sources	HPS	-	-	-	-	2000	4000	-	6400	-	9600	16000
		MH	-	-	-	-	2000	3400	-	5800	-	8000	12000

If the maximum limit in lumens is insufficient for residences with four or more dwellings, standard 5.2 shall apply.

5.2. All uses and applications, except residential properties of four or more dwellings

5.2.1. Maximum values of average maintained illuminance levels

Any lighting installation must be set up for a specific application or an equivalent task and must not exceed the standards for illuminance level, in lux, or the equivalent in lumens/m², as stipulated in Table 3.

Any application in which the total quantity of light used exceeds 150,000 lumens must be considered according to the average maintained illuminance levels in lux.

Only the surface for a specific application that is to be lit must be considered, regardless of the standard used (lux or lumen/m²).

The limit for the "Miscellaneous use, lighting building fronts, landscaping, driveways, etc." application is established according to the total area in m² of the exterior walls of the buildings on the property, regardless of whether the fixture is attached to the building or not.

5.2.2. Limit set in lux and point-by-point calculation requirement

When the standard for the quantity of light permitted is considered using an illuminance level in lux, a point-by-point calculation is required for the stardard to be approved and it must contain the following information: the lit surface, the type, number, height and location of luminaires, the light sources used and their nominal wattage, the maintenance factor used, the average initial illuminance level, and the average maintained illuminance level.

5.2.3. Limit set in lumen/m²

For the stardard to be approved when the standard for the quantity of light permitted is considered using a limit of lumens per square metre (lumen/m²), the lumens must represent the total lumens emitted by the light sources and the m² must represent the surface to be lit for the given application.

TABLE 3: Maximum values for average maintained illuminance levels in lux or the equivalent in lumens/m²

USE AND APPLICATIONS	**ENVIRONMENTAL ZONES**			
	1	**2**	**1**	**2**
	Lux (1)	**Lux** (1)	**Lumen/m²**	**Lumen/m²**
Commercial display area				
- All commercial areas (garden centre, materials, etc.)	30	40	100	150
- Display row for automobile dealerships	50	75	NA	NA
Storage area	10	10	30	30
Unloading, handling or work area	30	40	100	150
Pedestrian area	4	6	NA	NA
Building entrance	30	40	300	400
Illuminated sign	Banned	NA	Banned	NA
Reflection-illuminated sign	NA	NA	1,500	1,500
Street (for R2 and R3 reflective surfaces)				
- Village residential	4	6	NA	NA
- Village commercial (note 2)	8	10	NA	NA
- Urban commercial	10	12	NA	NA
- Industrial	6	6	NA	NA
- All streets located outside of the urban perimeter should not be lighted, except for crossroads.				
Outdoor parking	10	15	30	40
Service station				
- Pumping area	25	35	NA	NA
- Peripheral area (or other surface under a canopy)	10	15	NA	NA
Sports area (recreational and amateur use)				
- Rink, soccer, football	75	75	NA	NA
- Tennis	100	100	NA	NA
- Baseball: outfield	100	100	NA	NA
- Baseball: infield	150	150	NA	NA
- Other sports or professional use	IESNA base standard (4) to a maximum of 150 lux	IESNA base standard (4)	NA	NA
Miscellaneous use, lighting building fronts, landscaping, driveways, etc.	NA	NA	25 to a maximum of 15,000 lumens per building	

Notes
NA: Not applicable
(1) A margin of error of 15% is tolerated when a point-by-point calculation is done.
(2) Any agglomeration with less than 5,000 inhabitants is defined as "village."
(3) IESNA: Illuminating Engineering Society of North America, IESNA Lighting Handbook.

5.2.4. Illuminated signs

To limit glare and excess lighting, illuminated signs must be made of dark-coloured materials like the colours shown in the chart in Appendix A of these regulations. The lettering may be lighter and may not exceed 50% of the total area of the sign.

When the corporate logo is a colour that does not match any of the options on the colour chart, the sign must be reflection-illuminated.

Furthermore, signs must be lit with a minimum spacing of 30.48 cm (1 foot) between each fluorescent lamp.

6. Hours of operation

Any lighting fixtures used for non-residential applications, including signs, must be turned off at 10:00 p.m. or outside business or operating hours.

Any lighting used for security purposes (lighting for storage areas, streets, public pedestrian areas, building entrances) is exempt from the provisions in the preceding paragraph.

Commercial display and loading/unloading, handling or work areas must comply with the illuminance level set out for storage areas outside business or operating hours, or reduce the quantity of light used by 75%.

7. Exemptions

The situations below are exempt from these provisions. However, whenever possible, these regulations should be used as guidance for installations:

- The use of motion detectors;
- Light sources emitting less than 150 lumens;
- Temporary decorative lighting for the holiday season between November 15 and January 15;
- Lighting regulated by other provincial or federal regulations, such as lighting for communication towers, airports, etc.;
- Temporary lighting for special activities such as outdoor shows, village festivals, construction sites or other temporary work.

8. Minor exceptions (not applicable to the interim control regulations)

Any application or specific use where public safety may be compromised, such as hospital emergency areas, may be declared a minor exception as long as a study conducted by qualified professionals or lighting specialists shows that application of these regulations compromises the safety of property or individuals. These regulations must be used as guidance for installations.

Lighting to enhance building and landscape heritage that does not comply with the standards in these regulations may be declared a minor exception. However, the building must represent a heritage value or a specific architecture, and the landscape must be part of a tourist or cultural route. The enhancement concept must be completed by qualified professionals or lighting specialists and be guided by these regulations.

9. Acquired rights

All lighting fixtures existing before these provisions become effective shall have acquired rights. However, any lighting fixture modification, alteration, replacement or addition must comply with the provisions in these regulations.

10. Application for a certificate of authorization

10.1. Requirement for a certificate of authorization

Any installation of one or more lighting fixtures with a light source that emits more than 4,000 lumens or that reaches a total of 15,000 lumens in a single or several stages must be subject to an application for a certificate of authorization.

10.2. Application form

All applications for a certificate of authorization must be submitted in writing to the authority responsible for enforcing these provisions on a form provided by the municipality. The form must be duly completed and signed, and must be accompanied by the following information:

- A detailed description of the lighting fixtures and their locations;
- The nature of the lighting (i.e., use and application);
- The type of light source and nominal wattage;
- The type of luminaire;
- The point-by-point illumination calculation, if applicable;
- The photometric report for the luminaire issued by a certified laboratory, if applicable;
- Any other required or relevant information.